# POWER

POWER GENERATION, TRANSMISSION, APPLICATION AND THE ATTENDANT SERVICES IN ALL INDUSTRIES

TECHNOLOGY DEPT.

JANUARY, 1943

**Good diesel exhaust systems** improve plant performance. Practical pointers on designing the hookup. Starts on page 72

**Chemical scale removal** cuts boiler outage—data on new mobile acid-cleaning service. Page 82

**Your scrap job for 1943**—Power men must help keep steel mills operating by systematic and continuous salvage. Details of new industrial "dormant-scrap" drive on page 106

**Eliminate useless records** says Mt. Sinai Hospital supervising engineer. Make your log sheets work for you. See page 111

**Wartime Power Clinic**—Answers to emergency problems by practical power engineers. Page 103

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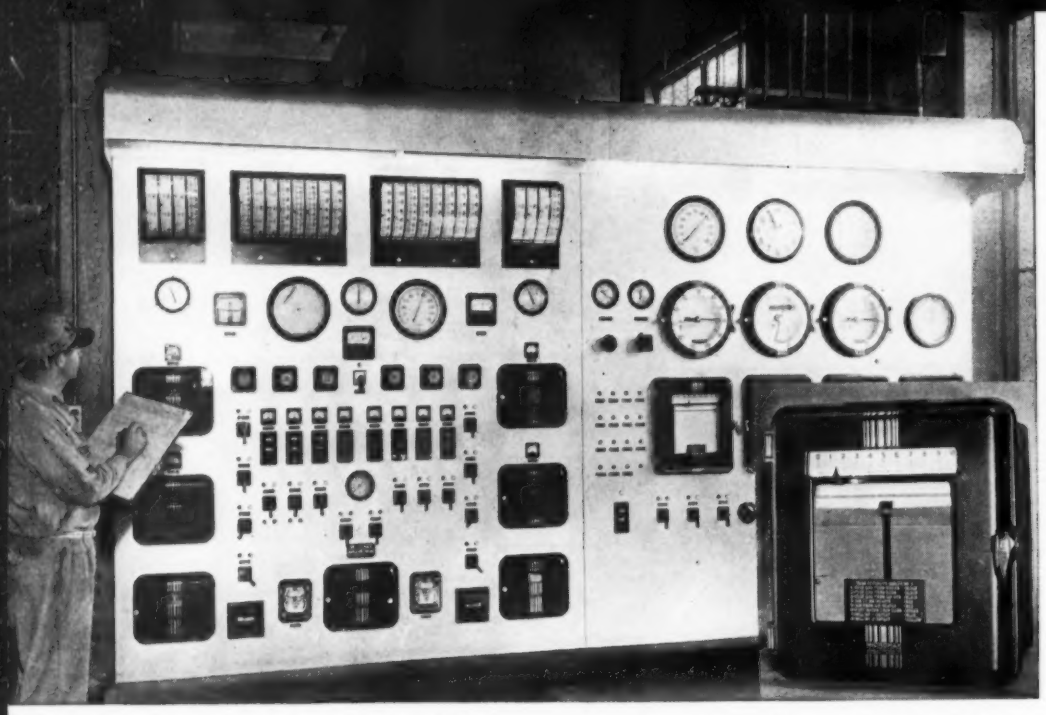


A central station arranged its L&N boiler-control equipment as shown here. Included are Metermax Combustion Control, Micromax Round-chart Recorders for superheated steam, steam purity and $CO_2$, and a Micromax Strip-chart Recorder for air, gas and water temperatures.

Micromax Recorder with tear-off device which makes removal of day's record as simple as removal of a round chart.

ARMY NAVY
*depends on me!*

# STRETCH YOUR MANPOWER
## With Instruments & Controls by L&N

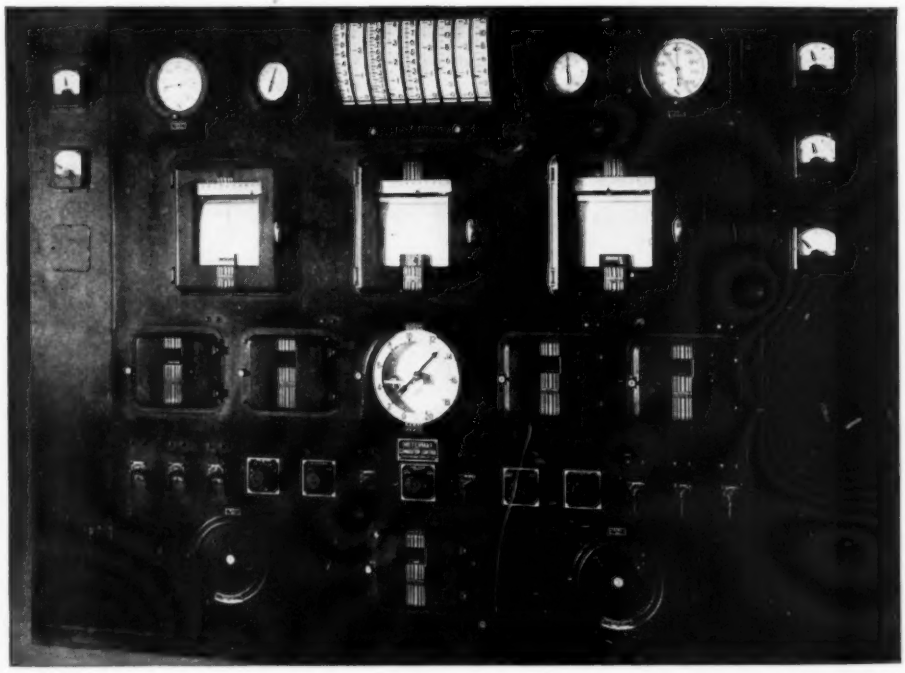
Supplied one at a time, or in completely-assembled panels, L&N's dependable, fully-automatic instruments and controllers are helping many a power plant which must stretch its remaining manpower. Typical groups of equipment are shown here.

*Micromax Flow Recorder.* For accurate determination of steam and water flow. The meter-body is the revolutionary, highly precise Centrimax (centrifugal-force) machine. Integrating and recording are separate, independent functions; neither affects the other. Integration is on the Recorder's counter; rate-of-flow is shown on record in typically thorough, visible, finely-detailed Micromax fashion. Recorder may be Strip-chart or Round-chart. For further information, write us or see Catalog N-28-160, 1942 edition.

*Micromax Temperature Recorders.* Multipoint instruments supplying multicolor (or single-color) records of temperatures of steam, gas, air, water, from any points at which thermocouples or Thermohms (resistance - thermometer bulbs) can be located. Records are extremely legible. Instruments may be equipped for automatic control of superheat. For further information, write us.

*Micromax $CO_2$ Recorder.* The simple, accurate, sensitive equipment which requires hardly more attention than does a pyrometer. Can be either a guide to manual adjustment of combustion, or can automatically operate fuel-air ratio setting of Metermax Combustion Control. For further information, write us, or see Catalog N-91-163, 1941 ed.

*Metermax Combustion Control.* For helping boiler furnaces meet any load conditions, without sacrifice of efficiency. Combines the sensitivity of electric control with the simplicity of pneumatic, to form equipment of outstanding dependability for medium and large plants. For further information, write us, or see Catalog N-01-163, 1939 ed.



Boiler-control panel in the powdered-coal power plant of a cement mill. Recorders, left to right, are Micromax for feedwater-flow; Micromax multipoint multicolor for temperatures of gas, air, feedwater and superheated steam; Micromax multipoint multicolor for temperatures of condensate and makeup; and, below, Micromax $CO_2$ Recorder. Shown also is complete Metermax Combustion Control. Complete assembly and wiring of this panel was done by L&N.

Jrl Ad N-163(9)

LEEDS & NORTHRUP COMPANY, 4910 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

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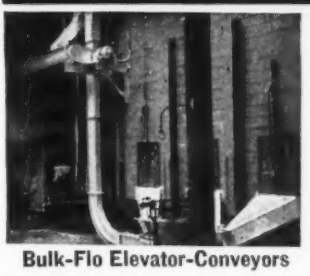
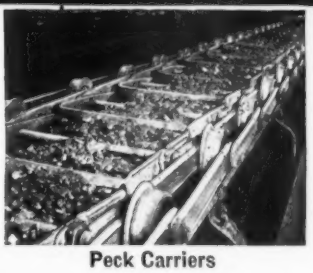
# COAL IN--ASHES OUT

## the *LINK-BELT* way

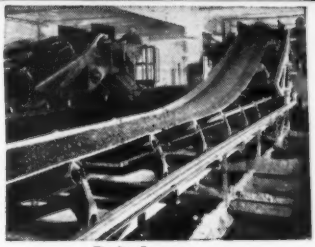
## MEANS EFFICIENCY AND LOW COST



Bulk-Flo Elevator-Conveyors

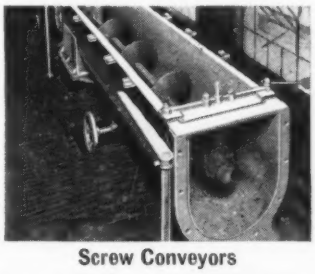


Peck Carriers

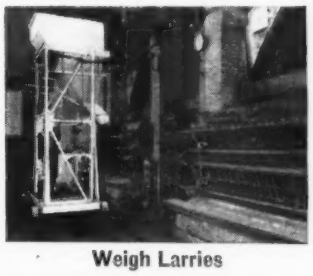


Belt Conveyors

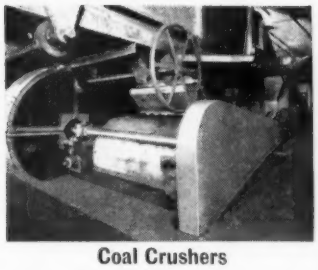
Bucket Elevators



Screw Conveyors

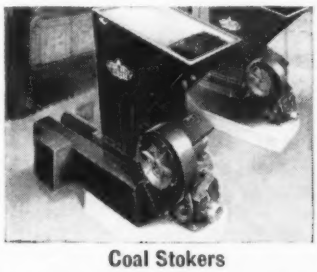


Weigh Larries



Coal Crushers

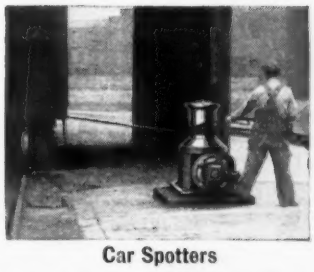
Skip Hoists



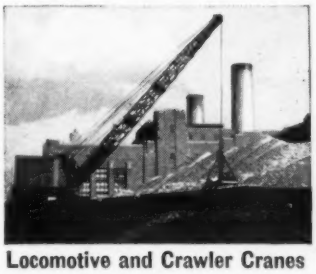
Coal Stokers

G-D Elevator-Conveyors

Unloading Towers

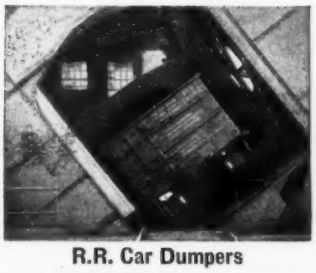


Car Spotters

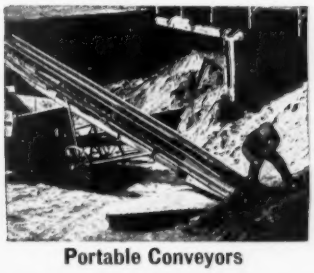


Locomotive and Crawler Cranes

Apron Conveyors and Feeders

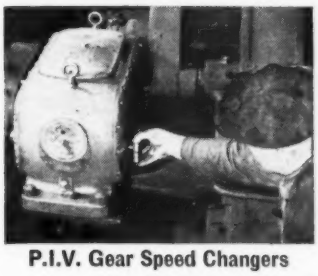


R.R. Car Dumpers

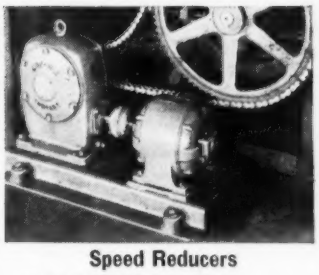


Portable Conveyors

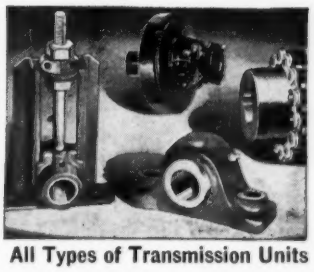
Chain Drives—All Types



P.I.V. Gear Speed Changers



Speed Reducers

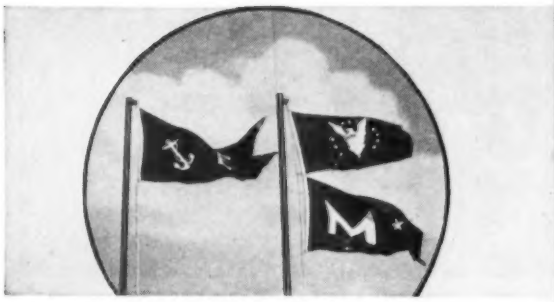


All Types of Transmission Units

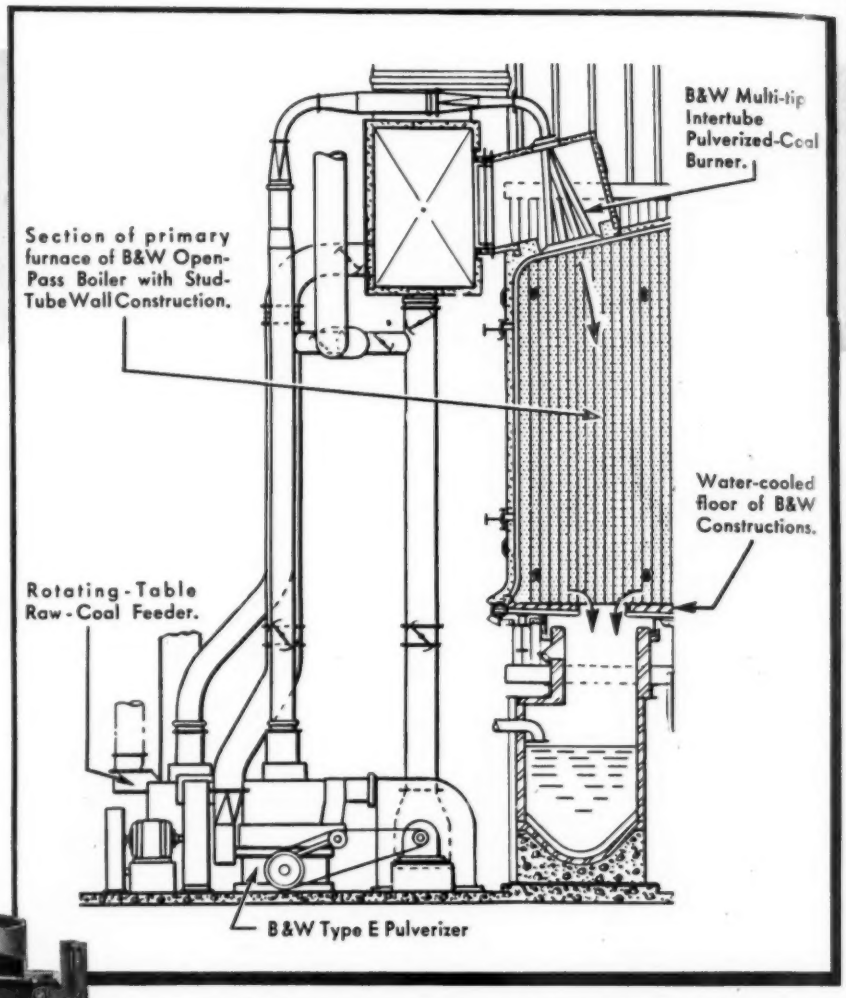
**LINK-BELT COMPANY**

Chicago, Indianapolis, Philadelphia, Atlanta, Dallas, San Francisco, Toronto; offices, warehouses and distributors in principal cities. 8985

**THROW YOUR SCRAP INTO THE FIGHT!**

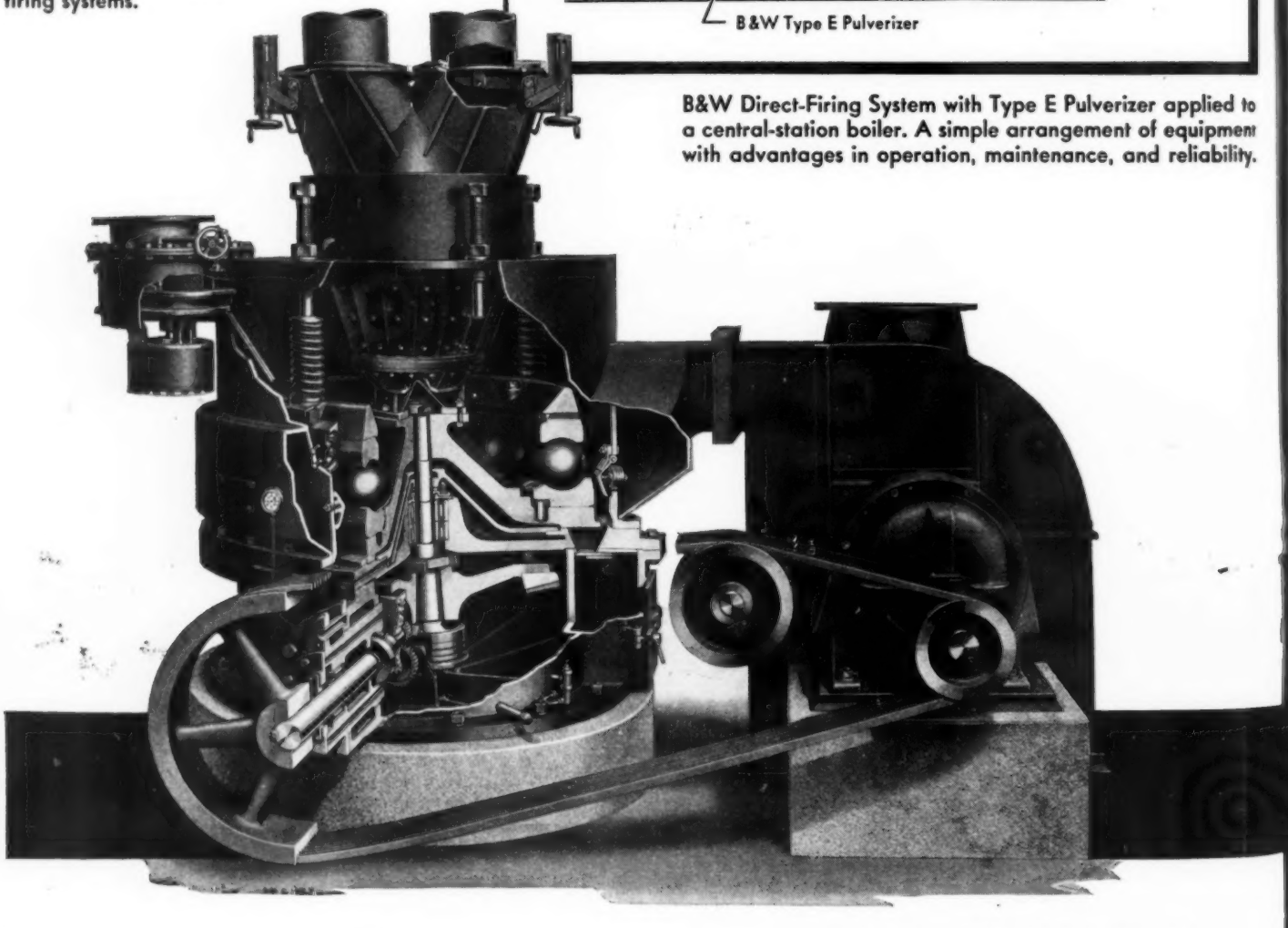


The Maritime Victory flag and "M" burgee now float proudly alongside the Navy "E" at the Barberton Works. Each is an award for "outstanding achievement" and is "an honor not lightly bestowed".


B&W Multi-tip Intertube Pulverized-Coal Burner.
Section of primary furnace of B&W Open-Pass Boiler with Stud-Tube Wall Construction.
Water-cooled floor of B&W Constructions.
Rotating-Table Raw-Coal Feeder.
B&W Type E Pulverizer

B&W Type E Pulverizer, with ball-bearing principle of grinding, for economy and reliability in direct-firing systems.

B&W Direct-Firing System with Type E Pulverizer applied to a central-station boiler. A simple arrangement of equipment with advantages in operation, maintenance, and reliability.



# B&W

## *Skill and Experience can Help You with your Steam-generating Problems*

Wartime operation of steam plants has brought many problems, the most general being those of how to get the most steam from existing equipment, and how to continue doing so for even longer periods than were heretofore considered possible. With new constructions there is the additional problem of selecting a unit through which possible entanglement in a critical fuel situation can be avoided. Getting the answers to these problems are "musts" — and, in most cases, they are already available — they are in B&W's book of "know how" compiled from practical experience that extends back to the beginning of the central-station industry.

One of the most pressing problems is that of fuels, which to provide for and how to utilize it to best advantage. Coal is the most abundant fuel, and undoubtedly will be continuously obtainable. Most coals are most efficiently burned in pulverized form in water-cooled furnaces. The answer to this problem lies in the use of the B&W Direct-Firing System and B&W Water-Cooled Furnace Constructions, both of which are, of course, readily applicable in original installations but are also applicable to conversion jobs. Provision for burning more than one fuel can readily be made, as B&W Multi-Fuels Burners have had wide application, and experience with them with every combination of commercial fuels assures proper operation. B&W Water-Cooled Furnace Constructions, with provision for suitable combustion and ash-conditioning zones in a boiler unit, provide the answer to the problem of furnace type.

Following up these suggestions may result in better, more efficient operation of many steam plants.

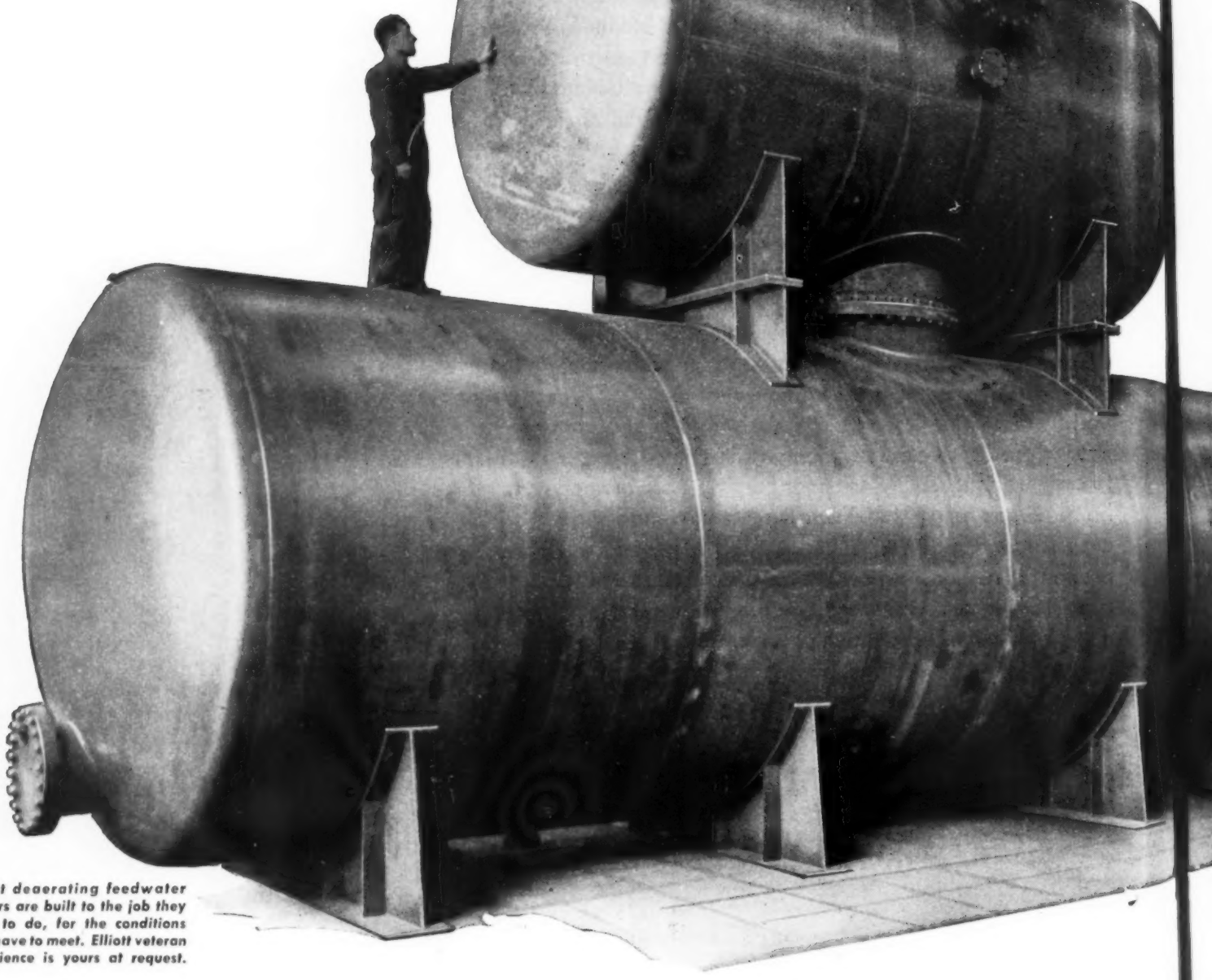
**THE BABCOCK & WILCOX COMPANY**
**85 LIBERTY STREET,**
**NEW YORK, N. Y.**

Equipment for 200,000 soldiers could have been produced with the time lost through accidents last year. This Company has subscribed to the National Safety Council's War Production Fund to Conserve Man Power, to help reduce accidents.

**BABCOCK & WILCOX**

G237-T

# ELLIOTT pioneering



*Elliott deaerating feedwater heaters are built to the job they have to do, for the conditions they have to meet. Elliott veteran experience is yours at request.*

# ELLIOTT

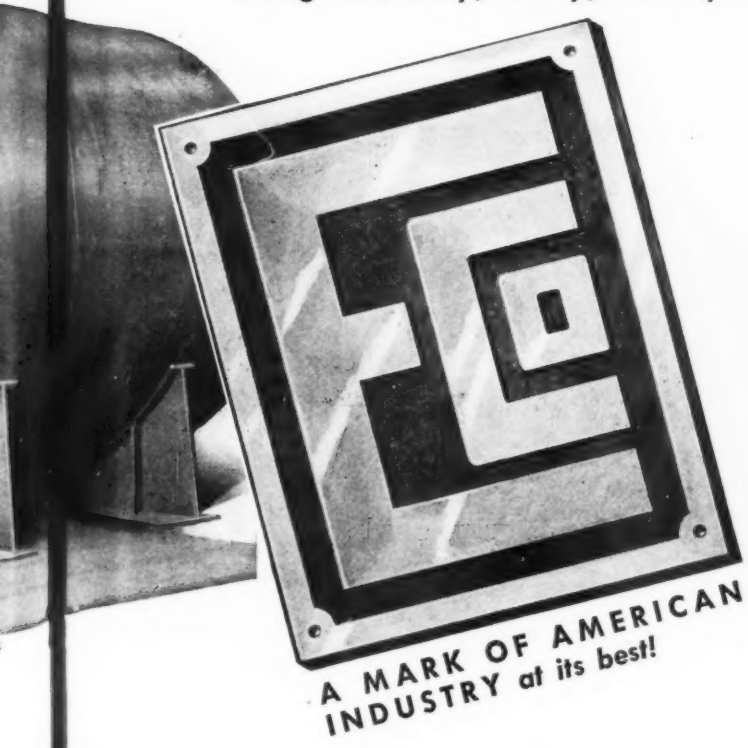
# gave Industry . . .

# DEAERATION

## --The power plant's strong arm in the War against Corrosion

It is a silent but deadly war against an insidious enemy — an enemy that rates as an ally of the Axis, like any other form of sabotage. This War with Corrosion is being won daily, hourly, in the power plants of America, by deaerating equipment designed on the basis of Elliott Company's past research and engineering developments in what was then an untrodden field of exploration.

Today, Elliott deaerating feedwater heaters serve power plants large and small. They prevent corrosion in boiler tubes and piping, by delivering feedwater free of dissolved oxygen. Furthermore, they promote boiler efficiency by delivering this water at saturated steam temperature. They are recognized by engineers as belonging in every heat balance cycle.



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**COMPANY** **DEAERATOR AND HEATER DEPT., JEANNETTE, PA.**

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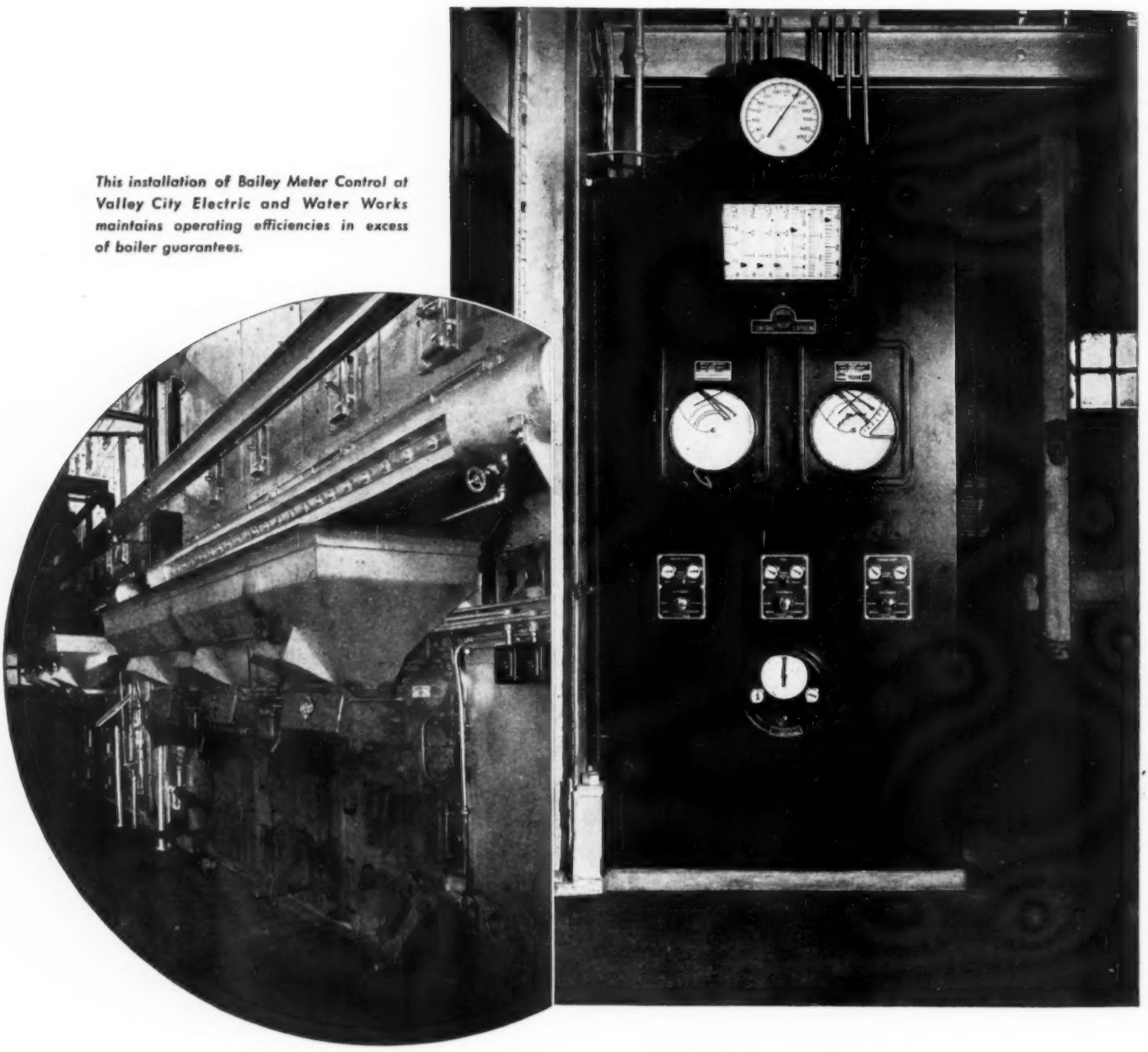
STRAINERS • SEPARATORS • GREASE EXTRACTORS • NON-RETURN VALVES • TUBE CLEANERS

# "BETTER THAN



*This installation of Bailey Meter Control at Valley City Electric and Water Works maintains operating efficiencies in excess of boiler guarantees.*

## BAILEY METER CONTROL . . .

BOILER METERS • MULTI-POINTER GAGES • FLUID METERS • RECORDERS • SUPERHEAT

# GUARANTEE EFFICIENCY"

## High Yearly Average Credited to *BAILEY METER CONTROL*

★ Sustained operating efficiencies in excess of boiler guarantees are being obtained at the Valley City Electric and Water Works Plant, Valley City, North Dakota. According to Mr. O.N. Bergman, Superintendent, Bailey Meter Control has kept his two new 60,000 pound per hour capacity 420 pound pressure, spreader stoker-fired boilers operating at better than guarantee efficiency since they were placed in service over a year ago.

The fuel economy of such performance is only one of the many benefits resulting from the plus values of Bailey Meter Control. Other benefits are:

1. Maximum steaming capacity always available.
2. Boiler outage reduced to a minimum.
3. Furnace refractories protected from excessive temperatures.
4. Prime movers favored by steam at design conditions.
5. Added protection against furnace explosion.
6. Normal operation automatically maintained during emergencies.

Bailey Meter Control is the Power Engineer's first lieutenant—always on duty to save fuel, protect equipment, and render reliable power service.

Ask for Bulletin No. 102-C which tells the full story of this complete Combustion Control System. A-70

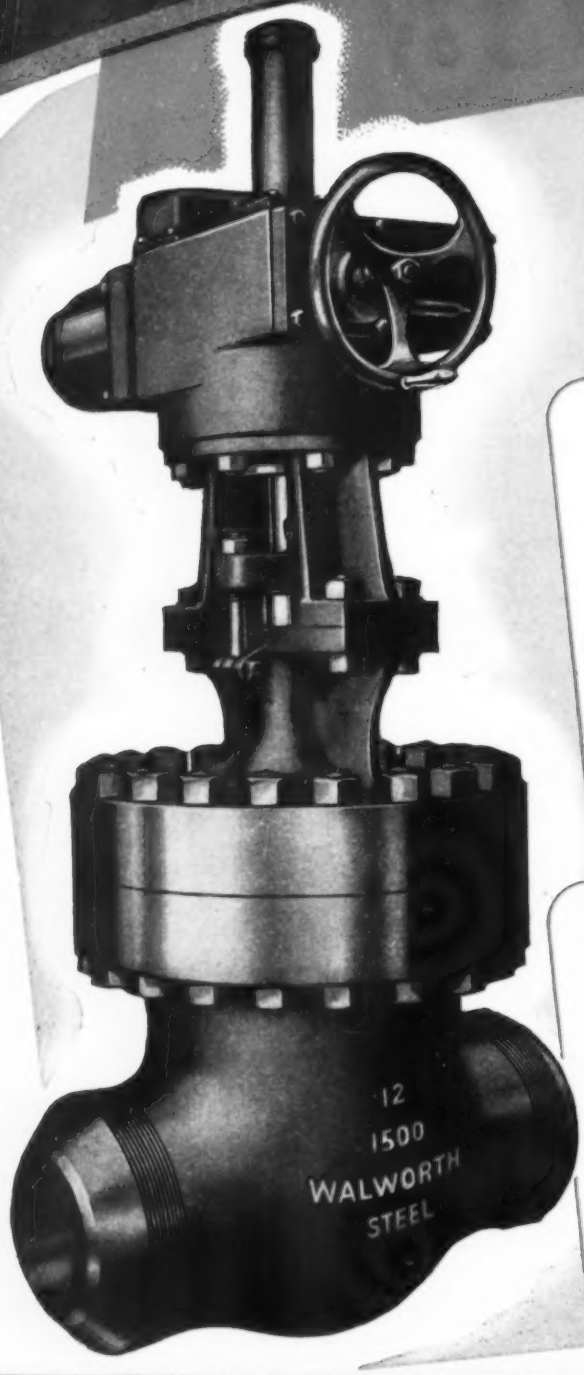
**BAILEY METER COMPANY**
**1036 IVANHOE RD., CLEVELAND, OHIO**
**Bailey Meter Company Limited, Montreal, Canada**

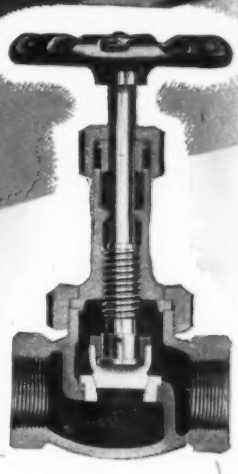
*The Complete Combustion Control System*

CONTROL • DESUPERHEAT CONTROL • COMBUSTION CONTROL • FEED WATER CONTROL

# WALWORTH

VALVES FITTINGS *for* TOOLS



## BRONZE VALVES

**Gate, Globe, Angle and Check**—These Walworth types are made for all pressures, temperatures, and services for which bronze valves are suitable. Walworth No. 225P Globe Valve, illustrated, has a stainless steel, plug type, seat and disc, heat treated to a minimum of 500 Brinell hardness. Boiler scale, sand, grit, and other foreign particles cannot mar the surface of either the seat or disc. Wire-drawing is practically eliminated. Extra large stems and long stem threads have been provided to decrease thread wear and increase valve life. Every part has been designed to assure maximum protection against wear and leakage. For complete information regarding Bronze Valves refer to Walworth Catalog 42, Sections 2-6.

## CAST STEEL VALVES

Illustrated at the left is a 12", 1500 lb. Walworth Steel Valve with welding ends. Walworth Steel Valves in all series can be furnished with welding ends, screwed ends, or flanged ends within the limits of war production. The complete line of Cast Steel Valves, in Gate and Globe types, have extra strength and protection due to heavy walls. Deep stuffing boxes eliminate costly leaks. Flow loss at high velocity is decreased by streamlined ports. Every detail of design, metallurgy, and construction helps to assure better and longer service. See Sections 16-17 of Walworth Catalog 42 for complete data on Cast Steel Valves.

# WALWORTH

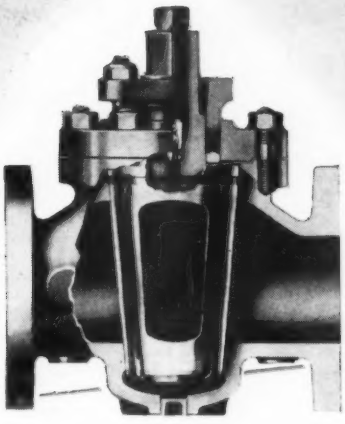
WALWORTH COMPANY
60 EAST 42nd STREET, NEW YORK

VALVES FITTINGS and TOOLS
Backed by 100 Years' Service

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

# STEAM · OIL · WATER · GAS · AIR

## and other liquids and gases

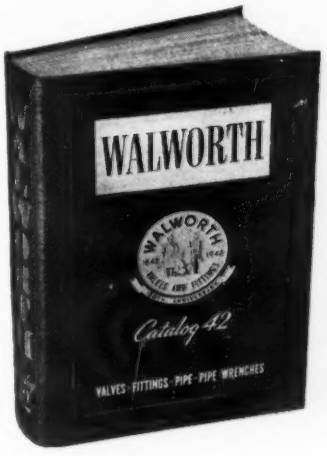


### LUBRICATED PLUG VALVES

Some fluids are difficult to control with conventional types of valves – but Walworth Lubricated Plug Valves do the job safely and easily. They may be opened or closed with but a quarter turn of the handle, and have proved their ability to give a dead-tight shut-off. Operation is sure and smooth. All these qualities plus greater protection against corrosion and erosion make Walworth Lubricated Plug Valves ideal for "difficult" jobs. They are made in sizes from ½ to 24-inches and for pressures from 125 to 5000 lbs. Complete information on Lubricated Plug Valves will be found in Section 15 of the new Walworth Catalog.

### WALSEAL FITTINGS

**For Leakproof "One-piece" Copper or Brass Pipe Lines –** Walseal Fittings are threadless bronze fittings into the ports of which the exact amount of silver brazing alloy has been inserted by Walworth at the time of manufacture. Joints are made by inserting the pipe end into the fitting port, then heating both pipe and fittings with an oxyacetylene flame. The result is a *Silbraz Joint* which saves time and effort, and which is silver-brazed – not soft soldered. A brass or copper line made up with Walseal Valves and Fittings is actually a "one-piece" line, leakproof, vibration-proof, shock-proof, and corrosion-resistant. Refer to Section 20 of Walworth Catalog 42 for complete information on Walseal Fittings.




### SPECIFY FROM THE NEW WALWORTH CATALOG 42

The new Walworth Catalog 42 is just off the press. It gives the latest information on any question concerning Walworth products. It is clearly indexed and contains complete up-to-date data on valves, fittings, and pipe, including working and test pressures, plus service recommendations. Conformity of metals to A.S.T.M., Marine, and U. S. Navy specifications is given in detail. Dimensions for layout and operation, as well as engineering data, make valve and pipe installations easier and add to the usefulness of this new Walworth Catalog 42. Be sure to get a copy. Fill out and attach the handy coupon to your letterhead.

*Address your inquiry to Dept.* **P1,**
*Walworth Co., 60 East 42nd St., N. Y. C.*

Please send a copy of the new Walworth Catalog 42 to:

*Name*_____

*Title*_____

*Company*_____

*Address*_____

*City*_____ *State*_____

WALWORTH 1842 1942 VALVES AND FITTINGS 100TH. ANNIVERSARY

**One hundred years ago Walworth first manufactured valves and fittings. Walworth has been manufacturing these products continuously ever since.**

# B. t. u. Savers – *that will*

## RECORDING THERMOMETERS

**Remote Reading—Single and Multiple Pen**

Republic thermometers are available for recording temperature of flue gas, temperatures in vats or tanks either open or closed and under pressure, temperatures in pipe lines, refrigeration systems, ovens, kilns or ducts. For unusual conditions, special bulbs are furnished of corrosion resisting metal or with a protective coating.

WRITE FOR DATA BOOK No. 210

## FLOW METERS

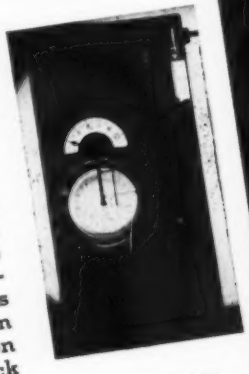
**Electrical Remote Reading Type**

Republic electrical type flow meters are available for measuring the flow of all types of liquids and gases. Meter bodies are built for metering fluids at line pressures up to 10,000 lb. per sq. in. and for all ranges of differential pressure. The reading instruments — indicator, recorder and integrator — are of the remote reading type.

WRITE FOR DATA BOOK No. 701

## $CO_2$ METERS

**An Automatic Orsat—For Checking Combustion Efficiency**

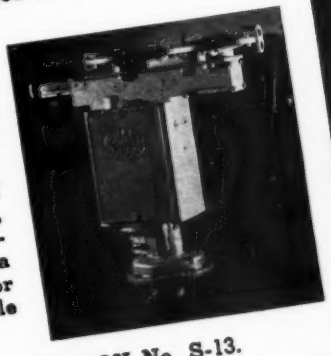


For every fuel and boiler, there is a definite percentage of $CO_2$ in the flue gas that will assure highest combustion efficiency. Less than this amount indicates an excess of combustion air, causing high stack loss. The $CO_2$ meter is the only method of accurately determining combustion efficiency.

WRITE FOR DATA BOOK No. 403

## REGULATORS

**Pressure — Flow — Speed — Level — Ratio**



Republic hydraulic or pneumatic type regulators are supplied for the automatic control of pressure, rate of flow, speed of rotation, level of a liquid or the proportioning of two pressures, flows, etc., in a fixed ratio by mechanically operating a valve, damper, rheostat or various types of variable speed transmissions.

WRITE FOR DATA BOOK No. S-13.

## BOILER WATER LEVEL CONTROL

**Sensitive — Powerful — Stable — Rugged**

The Republic boiler water level control system has been especially designed to meet the requirements of modern boiler operation. It is designed to maintain boiler drum water level within ±1 inch of the desired level under normal conditions.

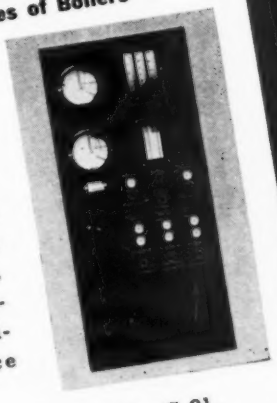
WRITE FOR BULLETIN No. S-50

REPUBLIC
INSTRUMENTS
AND CONTROLS

# *help you stretch wartime plant capacity*

## COMBUSTION CONTROL

**For All Sizes and Types of Boilers**

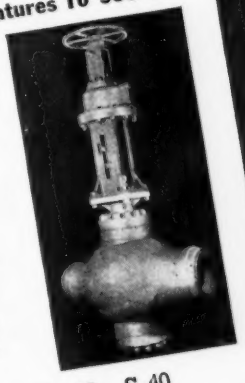


Republic automatic combustion control is available for all sizes of boilers, all types of fuel firing, all load conditions and any arrangement of draft equipment. It maintains constant steam pressure, highest combustion efficiency, desired load division, constant furnace draft.

WRITE FOR DATA BOOK No. S-21

## PRESSURE REDUCING AND REGULATING VALVES

**Pressures To 2500 lb.—Temperatures To 950 F.**



Republic turbine type valves are of the gradual-opening, high-lift type. They are built in accordance with A.S.A. standards and can be supplied for all pressures up to 2500 lb. per sq. in. and for temperatures up to 950 F and for any specified capacity. Republic valves will regulate down to 2% of maximum flow.

WRITE FOR BULLETIN No. S-40

## DRAFT AND PRESSURE INSTRUMENTS

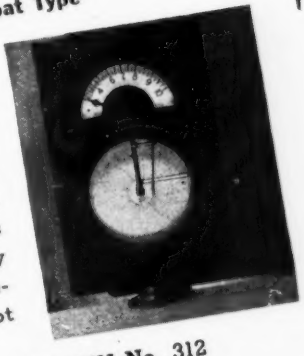
**Diaphragm Actuated Any Number and Combination**

Proper regulation of draft is one of the most important requirements in obtaining highest combustion efficiency. For indicating and recording drafts, pressures and differentials, Republic dry-bellows type indicators and recorders are supplied for all ranges encountered in furnace operation, in any desired combination.

WRITE FOR BULLETIN No. 802

## FLOW METERS

**Mechanical Float Type**



The Republic mechanical float type meter is a simple, accurate metering device for measuring the flow of steam, water, gas, compressed air, oil, brine and other fluids. It has been designed primarily for installations where remote registration is not required.

WRITE FOR BULLETIN No. 312

## DESUPERHEATERS

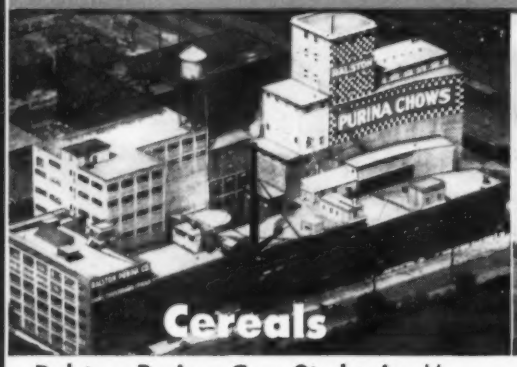
**Built To Meet Your Specific Requirements.** Whatever your plant conditions, you can obtain the necessary operating flexibility and accurate regulation of steam temperature with rugged, simply-controlled Republic desuperheaters. These are of the venturi type, with ratio or ratio-tank control, the steam atomizing type and the mechanical atomizing type.

WRITE FOR DATA BOOK No. S-35

# Republic Flow Meters Co.

2222 Diversey Parkway • Chicago, Illinois

# "FOOD WILL HELP




Ralston Purina Co., St. Louis, Mo. Nine contracts for seven plants. Total nine stokers.

International Salt Co., Watkins Glen, N. Y. Four Detroit Stokers —"Well pleased".

Nestles Milk Products, Inc., Marysville, Ohio. One of five plants using twelve Detroit Stokers.

# FOOD PLANTS DEPEND

Ward Baking Co., Detroit, Mich. One of five plants equipped with Detroit Stokers.

Rockford Dairies, Rockford, Ill. One of five "Dean" Milk Plants using Detroit Stokers.

American Crystal Sugar Co., Missoula, Mont. Use nine Detroit Stokers in three plants.

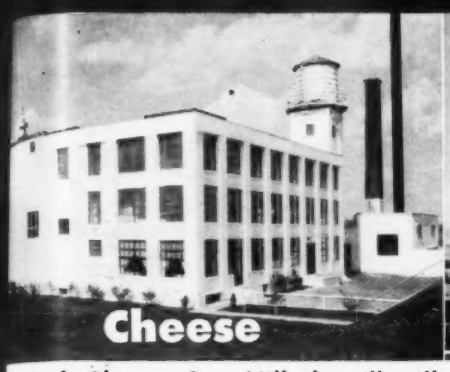
Rath Packing Co., Waterloo, Iowa. One Detroit Stoker—capacity 90,000 pounds steam.

The Crosse & Blackwell Co., Baltimore, Md. Have used Detroit Stokers since 1927.

Continental Baking Co., Detroit, Mich. Seventeen Plants use twenty Detroit Stokers.

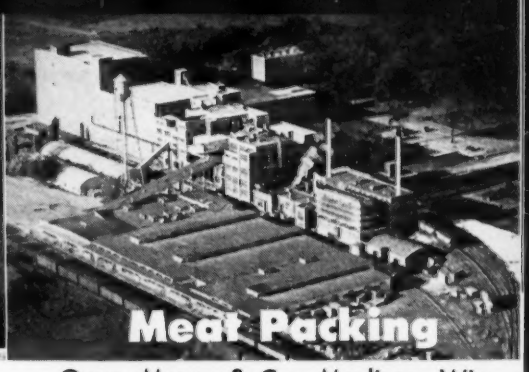
# WIN THE WAR"

CLAUDE R. WICKARD, SECY. OF AGRICULTURE




Kraft Cheese Co., Milledgeville, Ill. Detroit Stokers used in six Kraft Cheese plants.

General Foods Corporation, Corn Mill Division, Kankakee, Illinois. Uses Detroit Stokers.




Oscar Mayer & Co., Madison, Wis. One Detroit Stoker—capacity 75000 pounds of steam per hour.

# UPON DETROIT STOKERS

Lillie Mill Co., Franklin, Tenn. Used a Detroit Stoker since 1928. "Well satisfied".

The Borden Southern Co., Lewisburg, Tenn. One of fifteen Borden plants using thirty-one stokers.

Michigan Sugar Co., Saginaw, Mich. Nineteen Stokers in six plants —capacity 800,000 pounds steam.

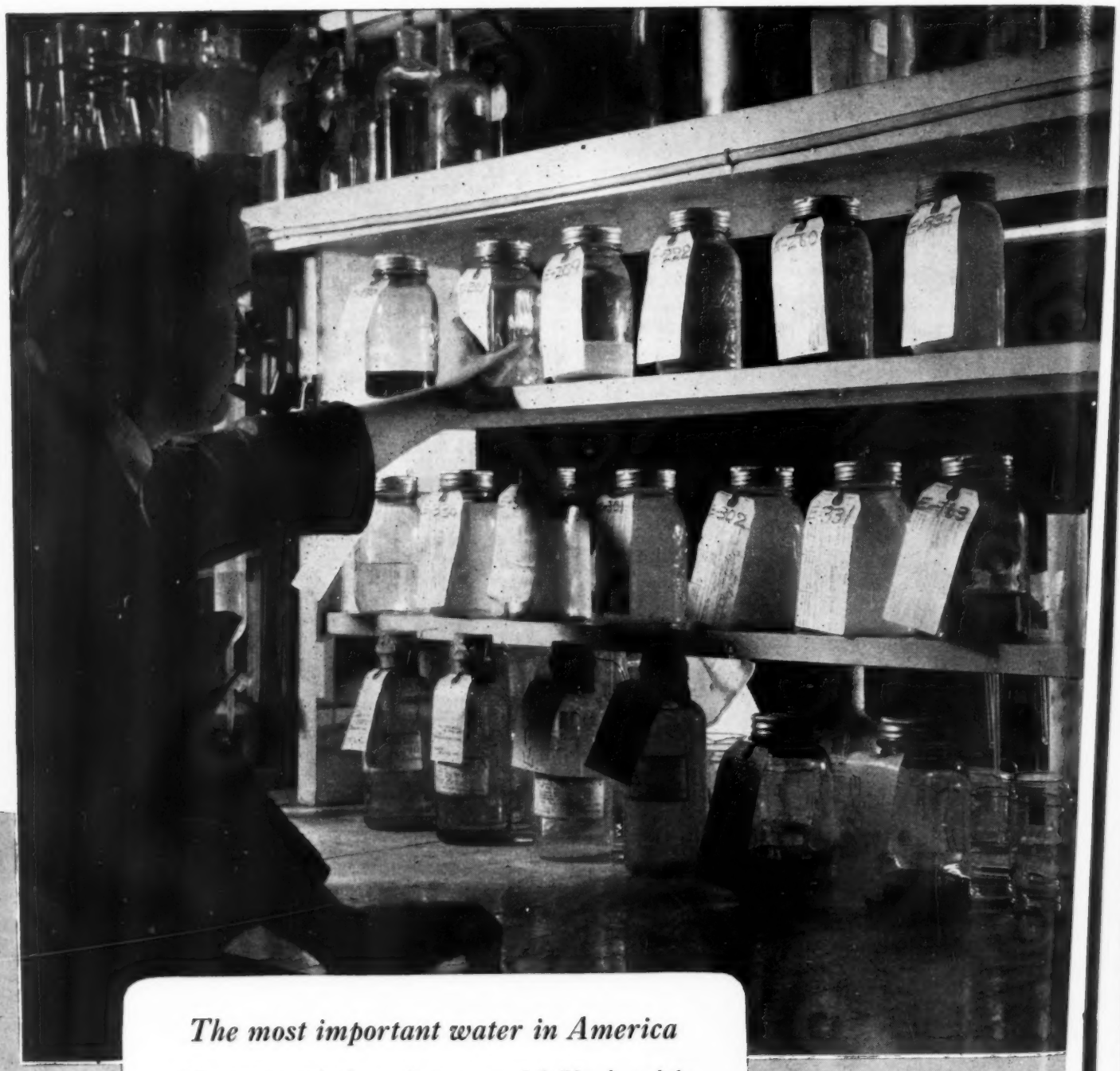
Libby, McNeill & Libby, Blue Island, Ill. Eight Detroit Stoker contracts for five plants.

**Soldiers and Workers must be fed. More Food means more Steam. Detroit Stokers contribute by handling heavier loads, and in successfully burning and conserving coal, "The Nation's Basic Fuel". Write for Bulletin 530.**

## DETROIT STOKER COMPANY

**Fifth Floor, General Motors Building, Detroit, Michigan**
**Works at Monroe, Mich. • District Offices in Principal Cities**
**Built in Canada at London, Ontario**

# This is no time to mince words



## *The most important water in America*

**Boiler water samples from a large army tank builder, four of the Nation's biggest steel mills, a large chemical plant, a major rubber company, a munitions manufacturer and other war plants. These steam plants and hundreds of others are producing 24 hours a day at top capacity with the aid of Hall Service.**

# over boiler water service!

## *Steam production is too vital to the war effort to rely on half-way measures*

NO part of your equipment is more important to you today than that which produces your power. None is driven harder or put to more severe tests. None would probably be more difficult to replace. Coddle it. Conserve it. But for victory's sake, if trouble does arise, don't trust its correction to half-way measures. Don't experiment. Don't guess.

Half the boiler outages we are called on to correct needn't have occurred. Half the repairs and replacements can be traced to incorrect diagnosis of their cause. They occur because there isn't a preventive specialist on the job.

***What preventive measures are you taking against the four major enemies of steam production . . . Scale — Corrosion — Carry-over — Embrittlement?***

Here's one thing leading steam producers have found it profitable to do—investigate Hall Service. For it offers what might be called "preventive medicine for boiler plant ills" in the most complete and practical form possible to obtain, a service which has *nothing* to sell but knowledge . . . the "know how" to keep boilers on the line.

The men who head the Hall organization are the men who contributed so much to the basic principles of sound water conditioning . . . the men who did the pioneering in this field . . . the men of whose work it may be truly stated that *there is no boiler plant in operation today that has not in some manner benefitted by their research.*

Thousands of case histories of industries served by Hall Laboratories offer a collection of facts and experiences that cannot possibly be equalled. Hall clientele is a Blue Book list of hundreds of the most important plants in the country.

Too much of the victory effort depends upon the maintenance of production . . . too much depends upon your own plants' production to mince words over the vital question of water conditioning service. Unless you are sure you have the best you can obtain . . . that it is *unquestionably* scientific and practice-proven, it is not good enough for you in times like these.

If there is one thing you want today, it is to be ready with *plenty* and *in time* to meet the problems of steam production under trying conditions. We would be glad for the opportunity to show you how Hall Service can provide it.

**HALL LABORATORIES, INC. · HAGAN BUILDING · PITTSBURGH, PA.**

### HALL SERVICE IN A NUTSHELL

***At your immediate disposal are placed the technical knowledge and facilities of the pioneering leaders in scientific boiler water conditioning. In addition, with your full co-operation, Hall Service:***

1. **Minimizes boiler outages caused by water.**
2. **Helps maintain highest efficiency.**
3. **Establishes non-embrittling water.**
4. **Minimizes carryover.**
5. **Prevents corrosion in boilers and associated equipment.**
6. **Prevents deposition in water lines and cooling systems.**

**HALL SYSTEM of Boiler Water Conditioning**

# Select the STAINLESS STEEL Best for Your Job

## *. . . and Save Vital Materials, Time and Money . . .*

All stainless steels are not alike. There are many different commercial analyses, and each analysis differs in physical properties. This variation in properties makes it important that you select a steel in light of the job it has to do. By careful selection of the proper stainless steel for your war-production job you can help conserve stainless steels and the metals used in making them . . . chromium, nickel, manganese, tungsten, columbium, and titanium. You will also save time and money.

Stainless steels are used throughout industry because of their superior resistance to corrosion and oxidation and their remarkable strength-weight ratio. Typical applications in essential industries are shown at the right.

We have more than 35 years' experience in the production, fabrication, and use of stainless steels. Although we do not make steel, we produce the "Electromet" ferro-alloys and metals used in making steels. Therefore, we are in a position to give impartial advice on selecting the steel best suited for your needs. If you have a problem involving the physical or metallurgical properties of stainless steel, call upon us. There is no obligation.

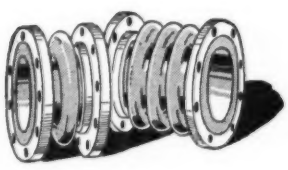
**ELECTRO METALLURGICAL COMPANY**

*Unit of Union Carbide and Carbon Corporation*

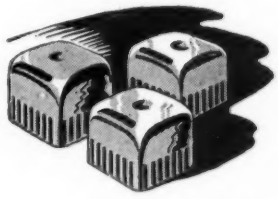
30 East 42nd Street UCC New York, N. Y.

In Canada, Electro Metallurgical Company of Canada, Limited, Welland, Ontario.

**Electromet**
Trade Mark
**Ferro-Alloys & Metals**

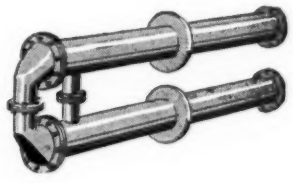


Expansion joints made of 18-8 stainless steel withstand corrosion in oil refinery piping.

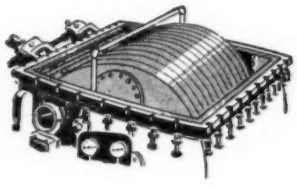


Bubble caps deep-drawn from 14 per cent chromium steel sheet are used in fractionating towers.

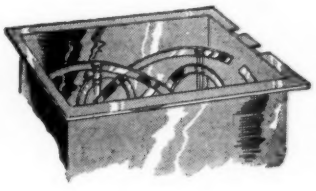
Aircraft engine collector rings of stainless steel stabilized with columbium, contain 1 to 2 per cent manganese.



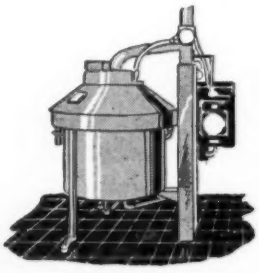
Heat exchanger of 18-8 molybdenum stainless steel resists hot organic acids under severe service conditions.



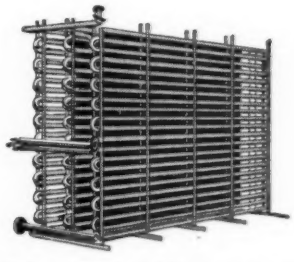
Stainless steel (18-8) drum and lining of this vacuum filter help keep products clean and pure.



Kneader made of 18-8 stainless steel is used in the manufacture of synthetic resins.

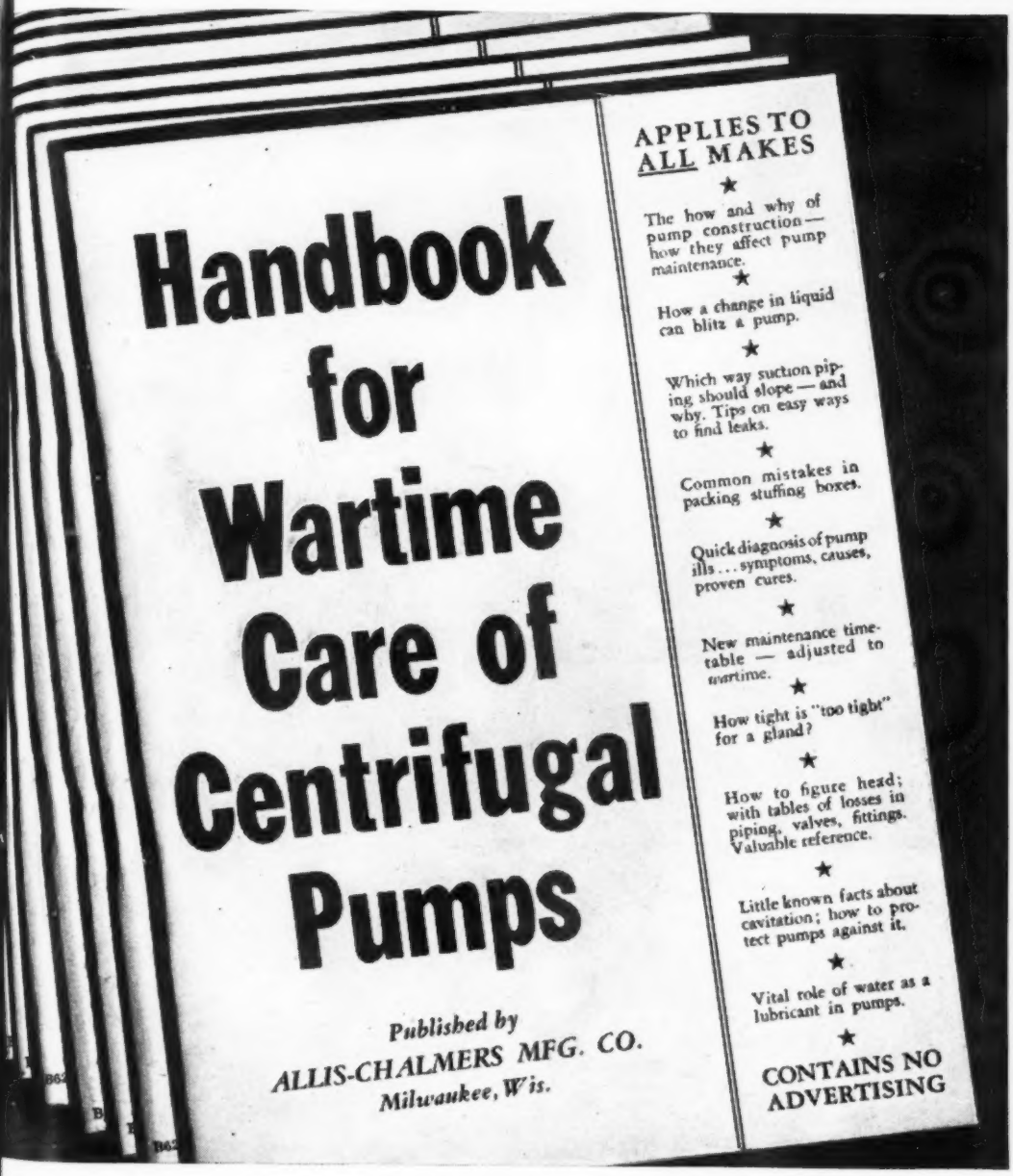


Irradiator used for increasing the active Vitamin D content of milk is made of 18-8 stainless steel.



Nitric acid cooler of 18 per cent chromium steel resists corrosive chemical action.

# Fresh Off the Press!


Handbook for Wartime Care of Centrifugal Pumps
APPLIES TO ALL MAKES
★
The how and why of pump construction — how they affect pump maintenance.
★
How a change in liquid can blitz a pump.
★
Which way suction piping should slope — and why. Tips on easy ways to find leaks.
★
Common mistakes in packing stuffing boxes.
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Quick diagnosis of pump ills . . . symptoms, causes, proven cures.
★
New maintenance timetable — adjusted to wartime.
★
How tight is "too tight" for a gland?
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How to figure head; with tables of losses in piping, valves, fittings. Valuable reference.
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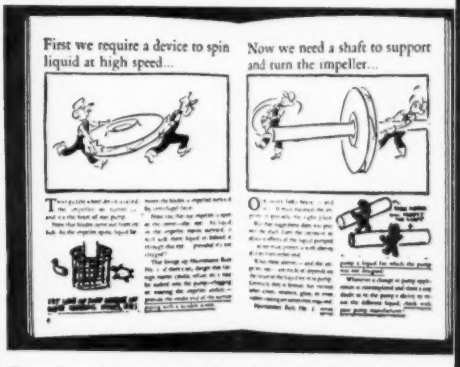
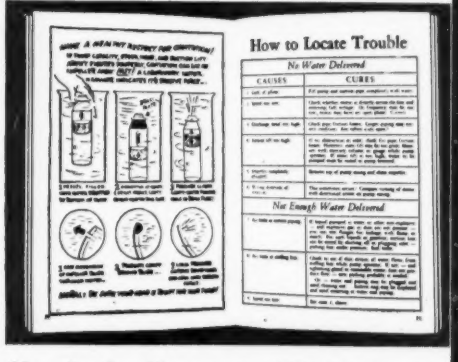
Little known facts about cavitation; how to protect pumps against it.
★
Vital role of water as a lubricant in pumps.
★
CONTAINS NO ADVERTISING
Published by
ALLIS-CHALMERS MFG. CO.
Milwaukee, Wis.

**ALLIS-CHALMERS ANNOUNCES A NEW CENTRIFUGAL PUMP MAINTENANCE GUIDE ...JAM-PACKED WITH NEW IDEAS YOU NEED TODAY! THIS VALUABLE NEW BOOK BELONGS IN YOUR TECHNICAL LIBRARY!**

HERE'S THE 1942 pump maintenance problem in a nutshell: pumps that worked 1800 hours in a peacetime year are now working *8700 hours* a year. Solution? The *new* standard of pump care set forth in this new handbook . . .




Step by step a centrifugal pump is *built* . . . and as each part is added, the way it's built and functions are seen to determine the way it should be *cared for!*




Abundantly illustrated, Allis-Chalmers' new maintenance guide makes *specific* recommendations for putting pump care on a wartime basis. And it's *free*. Tear out and mail the order form below *today!*

***Free!*** As one of America's leading builders of centrifugal pumps, Allis-Chalmers recognizes the great and growing contribution of maintenance to the war effort — and will gladly mail copies of "Handbook for Wartime Care of Centrifugal Pumps" *free of charge* as long as the supply lasts. This important new manual applies to *all* makes — contains no advertising. Send in today for *your* free copy! →

**ALLIS-CHALMERS**
**MILWAUKEE**

WE WORK FOR VICTORY — WE PLAN FOR PEACE

ALLIS-CHALMERS MFG. CO.
Milwaukee, Wisconsin

Gentlemen:
Yes, I would like to receive *free of charge* a copy of your "Handbook for Wartime Care of Centrifugal Pumps".

(Name)

(Title)

(Company)

(Street Address)

(City and State)

A-1574

Every Lunkenheimer valve is regularly tested on both sides at low and high pressure for seat tightness, and then given a shell test. The slightest leak causes rejection. Test pressures far exceed rated pressures.

*But*

**Fig. 2125 — 125 lb. S.P.**
**Bronze Double Disc Gate Rising Stem**

# LUNKENHEIMER

# The Final Test of a Valve . . . . is Performance

Fig. 2129 — 125 lb. S.P.
Bronze Wedge Disc Gate
Non-rising Stem

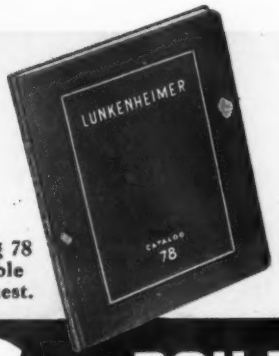
How does it hold up in service? Does it stand the gaff of hard usage? Is it dependable? Is it economical to use? How does it stack up in lasting qualities? The answers to these questions are the final and only convincing test of a valve. Ask any production man.

Now, when performance is more important than ever, when unnecessary time out for repairs is waste, and new valves aren't so easy to replace, users are profiting from their foresight in buying Lunkenheimer.

Rigid testing procedure is but one of the many precise steps in manufacture by which Lunkenheimer has maintained valve quality through the years. These steps are your assurance that Lunkenheimer Valves will give you more in uninterrupted performance for today's non-stop production schedules.

•

Since virtually all materials used in the manufacture of valves are on the list of critical materials, valve users are urged to furnish the highest possible preference ratings and proper "end use" information on their orders. This will be of mutual helpfulness.




Catalog 78 available on request.

ESTABLISHED 1862
THE LUNKENHEIMER CO.
"QUALITY"
CINCINNATI, OHIO. U. S. A.
NEW YORK CHICAGO
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**VALVES** **BOILER MOUNTINGS LUBRICATING DEVICES**

No. 28-105-42

# Get the top price for your Monel and rolled Nickel scrap

## *Segregate and avoid contamination*

THE U. S. war industry is today in urgent need of Monel and rolled Nickel scrap.

Every pound you turn in is of real and immediate aid. And every such pound of scrap that is not contaminated with other metals, that is free of oil and dirt and properly segregated will return a higher price per pound to you.

When sent with proper authority direct to the Huntington Works of The International Nickel Company, Monel and rolled Nickel scrap is remelted into the form of pig. This is used, by the steel industry, in the making of important alloy steels.

Remember your effort in this scrap drive is not only a fine contribution to victory, it can pay you a substantial cash dividend.

The table and notes at right will help you in the sorting and identification of scrap metals.

**QUALITATIVE TESTS FOR IDENTIFYING SOME COMMON WHITE METALS AND ALLOYS**

| MAGNETIC TEST | NITRIC ACID TEST | | | Iron Nail Test for Copper | Material Probably is |
|---|---|---|---|---|---|
| Reaction to Magnet | Reaction to Conc. Acid | Reaction to Acid after Dilution | Color of the Solution | | |
| Magnetic | Reacts Slowly | Reacts Slowly | Pale Green | No Copper Plates out | Rolled Nickel |
| Magnetic* (slightly) | Reacts | Reacts Slowly | Greenish Blue | Copper Plates out | Monel |
| Non-magnetic | Reacts | Reacts | Bluish Green | Copper Plates out | Copper-Nickel Alloy containing less than 60% Nickel, e.g. Nickel-Silver |
| Magnetic | Reacts Slowly | Reacts | Brown to Black | Not required | Steel or Cast Iron |
| Non-magnetic | Reacts Slowly | Reacts | Brown to Black | Not required | Ni-Resist |
| Magnetic | No Reaction | No Reaction | Colorless | Not required | Straight Chromium Stainless Steel |
| Non-magnetic† | No Reaction | No Reaction | Colorless | Not required | Chromium-Nickel Stainless Steels e.g. "18-8" |

*Monel is usually but not always slightly magnetic at atmospheric temperature. Monel that appears to be non-magnetic at atmospheric temperature may become magnetic when cooled by dipping in ice water or in a freezing mixture—other copper-nickel alloys of lower nickel content do not become magnetic. Monel that is magnetic at atmospheric temperature loses its magnetism when heated by dipping in boiling water. This test serves to identify Monel when only a magnet is available—no other common material loses its magnetism in this temperature range.

†"K" Monel is always non-magnetic even when cooled; therefore chemical analysis is required to distinguish "K" Monel from the copper-nickel alloys of lower nickel content.

### NOTES ON CARRYING OUT TESTS

#### *1. Magnetic Tests*

Bring the magnet in contact with the specimen to be tested. (Be sure that there is no magnetic material such as iron or steel beneath or in the immediate vicinity of the specimen.) The magnet will or will not be attracted to the specimen.

In cases of doubt, and especially where the material appears to be non-magnetic, use a more sensitive testing method:

*(a)* Balance the magnet or the specimen on the edge of a bench or desk. Then bring the specimen close to the magnet, or vice versa. If the material is magnetic the balance will be upset and a movement of either the magnet or the specimen will be observed.

*(b)* Another method is to suspend the magnet on a string and bring it close to the specimen. A slight movement of the magnet will be observed if the specimen is even slightly magnetic.

#### *2. Nitric Acid Tests*

Clean test surface so that the acid will come into direct contact with the material.

Apply one or two drops of concentrated nitric acid to the clean metal surface.

Let acid remain in contact with the metal for a minute or two.

Observe any reaction that takes place.

Dilute acid by adding three or four drops of water, one drop at a time.

Observe reaction: If solution turns green or blue do not disturb until nail test has been completed.

#### *3. Copper Test with Iron Nail*

If nitric acid test forms green or blue colored solution, make test for copper:

Rub a clean iron nail in the colored acid solution on metal surface, keeping nail in contact with the specimen.

If the alloy contains copper, there will be a deposition of copper either on the nail or on the surface of the metal under the acid solution.

Add a drop or two of additional water as the nail is rubbed around to prevent the deposited copper from re-dissolving in the acid.

### *IMPORTANT!*

**No Monel and rolled Nickel scrap should be sent to Huntington without authorization.**

**Authorization must be obtained from the Scrap Salvage Section, Monel and Rolled Nickel Sales Department, The International Nickel Company, Inc., 67 Wall Street, New York, N. Y.**

**Letters requesting authorization should state:**

**1. Kind of metal (Monel or Rolled Nickel)**

**2. The amount**

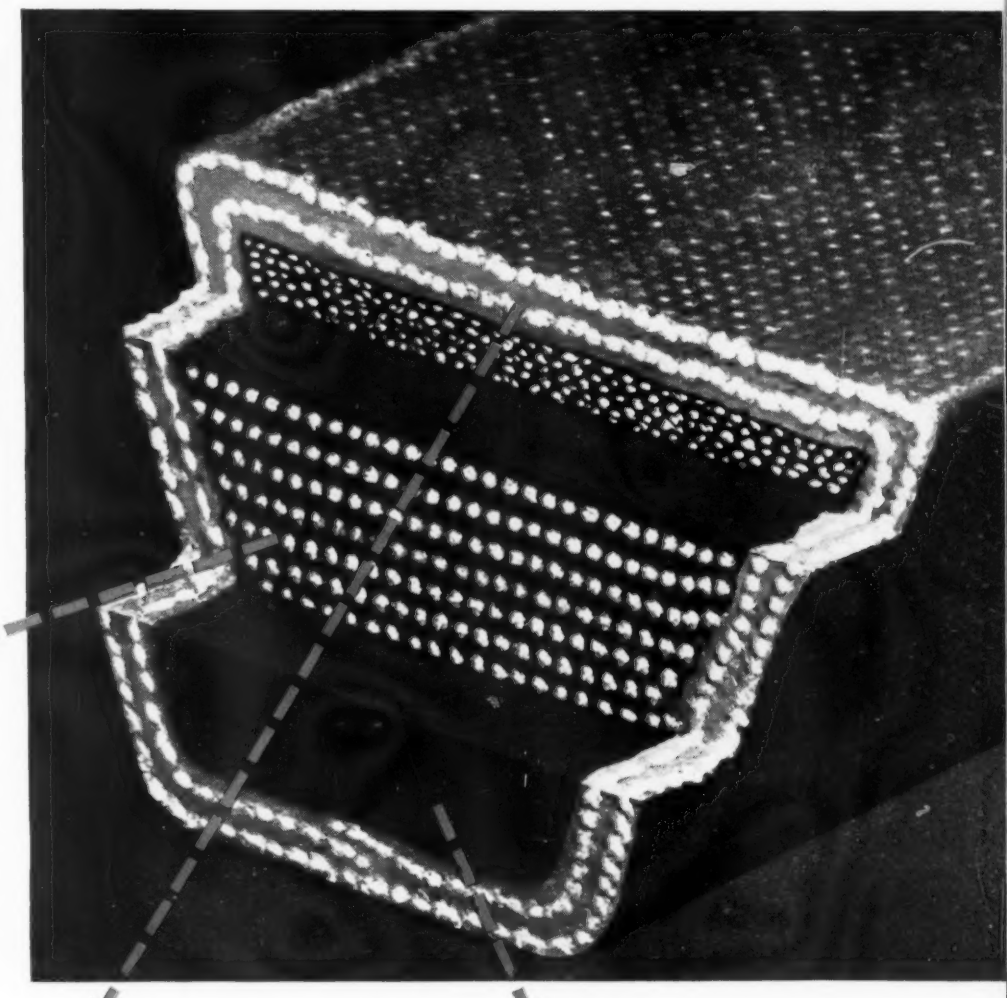
**3. Type of scrap—turnings, forgings, castings, strip, sheet, etc.**

**THE INTERNATIONAL NICKEL COMPANY, INC.**
**67 Wall Street** **New York, N. Y**

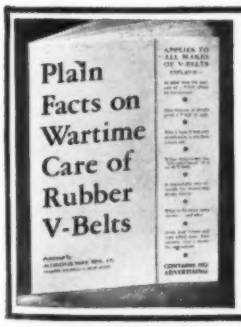
# Anatomy of WARTIME V-BELT Maintenance

**You'll find this Cutaway of the new, advanced Texrope Super-7 well worth a Moment's Study... for how it's *Built* tells you a Lot about how to *Care* for V-Belts — whatever "Make" you Use! And proper Care of the rubber V-belts driving around 70% of America's production machines is a Wartime *must!***

*V-Day needs every V-Belt*



**MUSCLE..** The 50% stronger cords and 20% *more* cords produced by the Flexon process give the new Texrope Super-7 extra muscle. To protect the pulling strength of *your* V-belts — regardless of their brand — keep them pulling *steadily*... without the slipping and grabbing that can jerk the life out of V-belts. That means keeping proper tension. Good rule-of-thumb for measuring it: "When struck with the hand, properly taut V-belts have an alive springiness."




**Free!**

Every engineer and executive should have a copy of this valuable new handbook in his technical library. It's packed with timely facts... applies to *all* makes of V-belts. Send for it today!

**SKIN..** Texrope Super-7's tough, new Duplex-Sealed cover protects the inner belt structure against grit, grime and moisture. And what protects any V-belt's *cover* is — maintenance! So here are 3 rules for care of covers... 1. Keep grease or oil from reaching them — quickly remove it with a solvent if it does (*never* apply belt dressings to rubber V-belts!); 2. If gritty dust threatens abrasive wear, shield your V-belts; 3. Maintain proper tension to prevent slip and heating.

**PAD..** Just as the bones of the human foot "ride" on the sole's pad of fat, so the pulling cords of a V-belt "ride" on a pad of rubber... which eases them around sheaves. Texrope Super-7's pad is of special, cool-running rubber which combats heat, dangerous enemy of rubber. *You* can fight heat by preventing misalignment in your drives. When present, it subjects the sides of V-belts to needless rubbing, sharply raises belt temperatures. So keep the shafts of drives parallel, sheave grooves in line.

☛ ***When you do Need new V-belts, invest in the Best...Texrope Super-7!***

A 1545

# ALLIS-CHALMERS

WE WORK FOR VICTORY — WE PLAN FOR PEACE

## TEXROPE* SUPER-7 V-BELTS

*Trade mark registered U. S. Patent Office. Texrope Super-7 V-Belts are the result of the cooperative research and design genius of two great companies — Allis-Chalmers and B. F. Goodrich — and are sold exclusively by Allis-Chalmers. Available in all sizes.....½ h.p. to 2,000 h.p.

# Iron Fireman Cuts Steam Costs

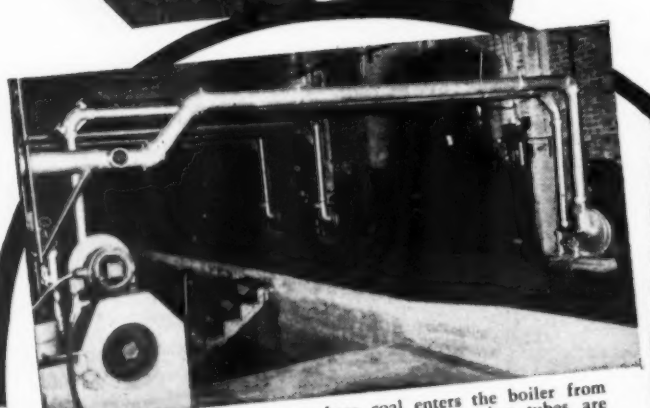
## Fuel Cost Savings

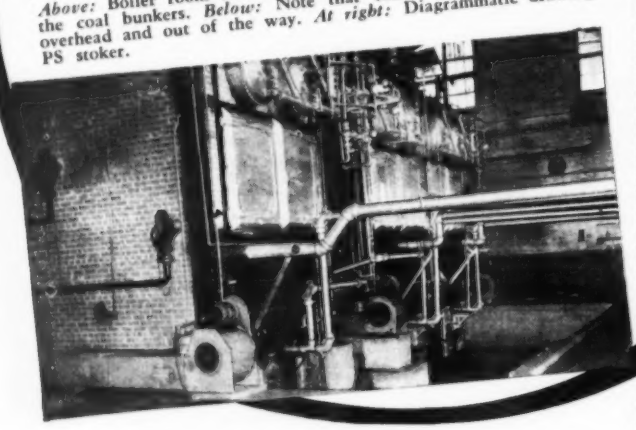
Marshall C. Stone, vice president and general manager, Pacolet Manufacturing Company.

THE Pacolet Manufacturing Company has cut steam costs from $0.349 to $0.237 per thousand pounds by the installation of Iron Fireman pneumatic spreader stokers. This reduction of 32% in steam costs amounts to fuel savings of $14,784 a year, according to Marshall C. Stone, vice president and general manager, who adds: "The investment will be self-liquidating in a short time."

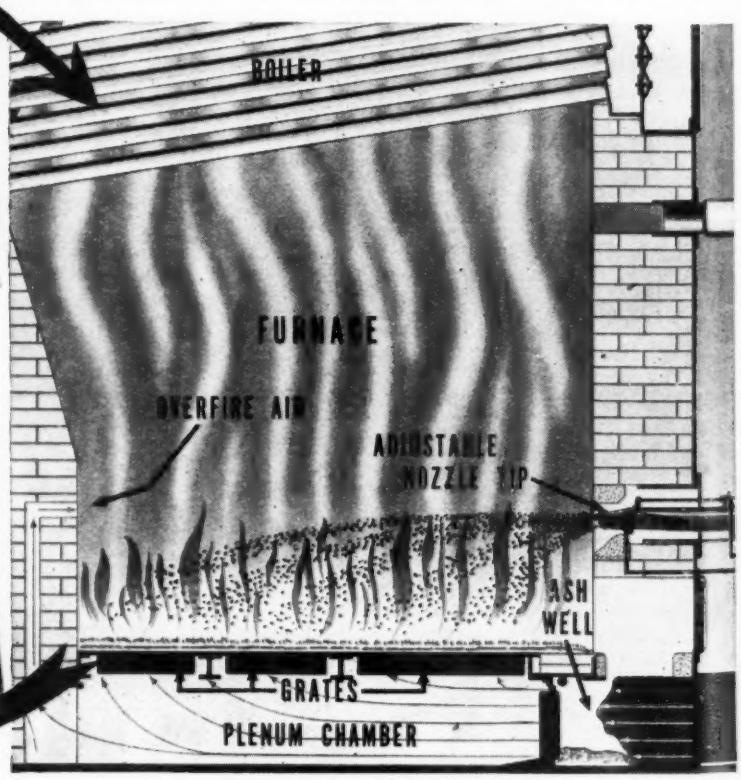
Facts speak louder than claims. Iron Fireman makes no premature claims as to what it can do for you, but Iron Fireman equipment has made such outstanding achievements in so many industrial plants that we do urge you to ask us for a survey and recommendation. Each boiler room has peculiarities of its own, of course, but the Pacolet job is in many ways a remarkable example of modernization.

There are three B & W Vertical Baffled boilers rated at 266 h.p. at 145 pounds pressure. These boilers are 38 and 40 years old. One boiler had been out of commission for 15 years. The boilers are now operating at 77.5% efficiency with a processing load. Two boilers



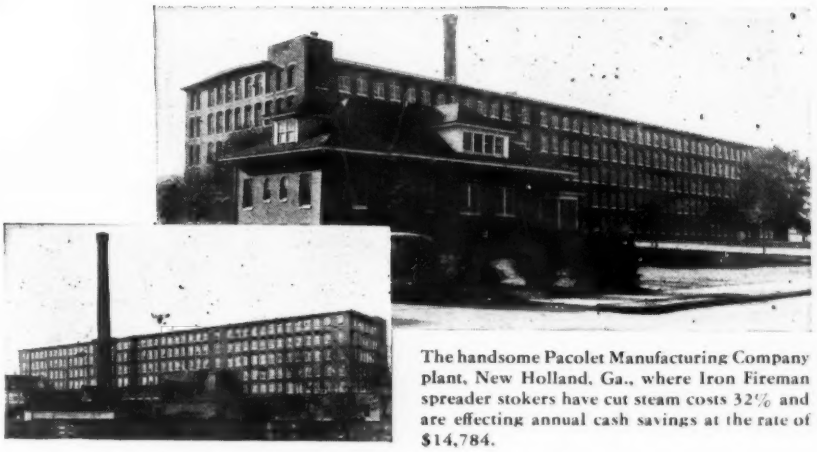


*Above:* Boiler room showing where coal enters the boiler from the coal bunkers. *Below:* Note that coal conveying tubes are overhead and out of the way. *At right:* Diagrammatic drawing PS stoker.



# 32% at Pacolet Mills

## $14,784 a Year



The handsome Pacolet Manufacturing Company plant, New Holland, Ga., where Iron Fireman spreader stokers have cut steam costs 32% and are effecting annual cash savings at the rate of $14,784.

operate at 110% of rating with a processing load in summer, and in winter with a heating load in addition to the processing load, they operate at 165% of rating.

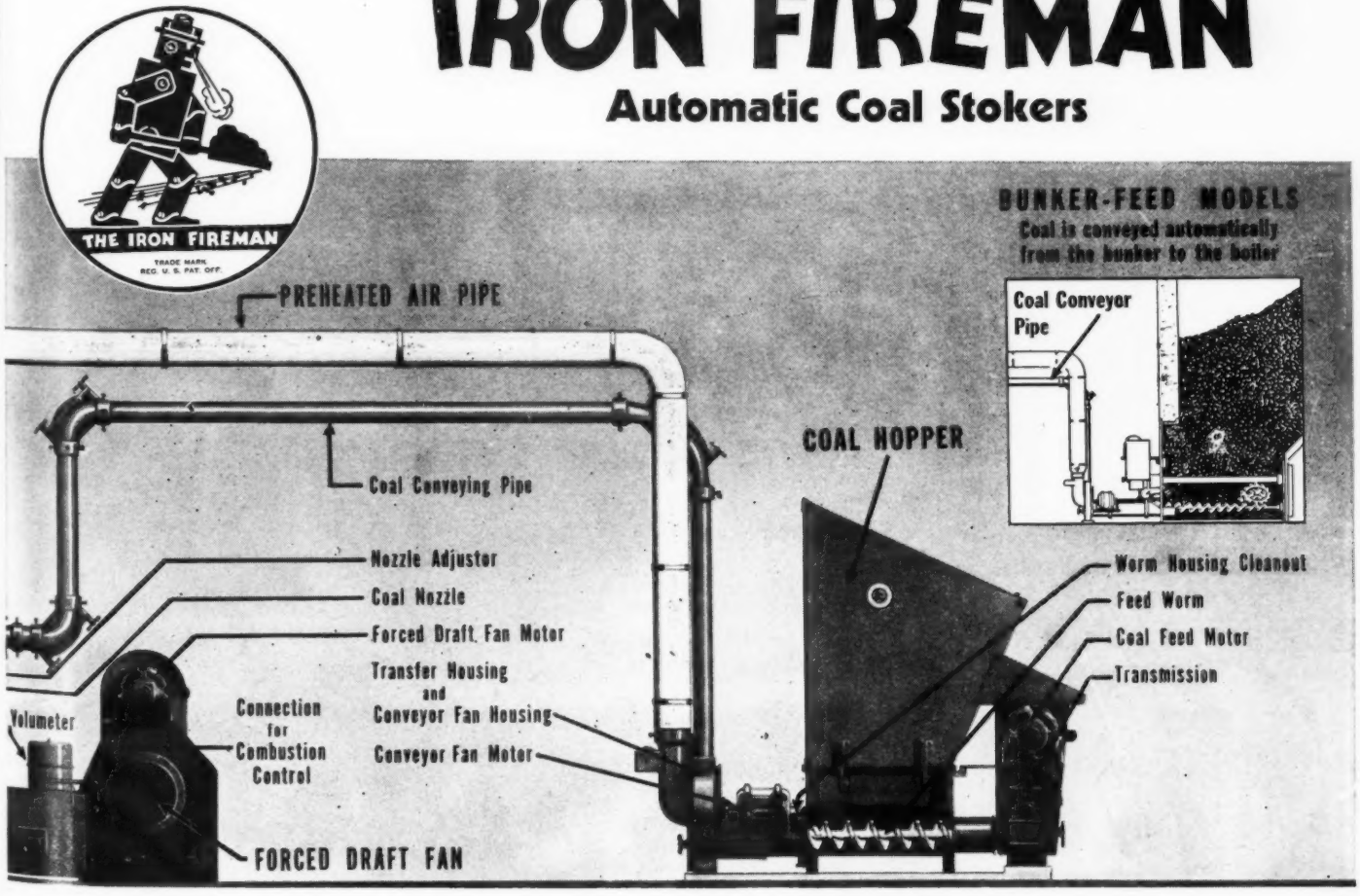
In addition to the fuel saving, considerable labor cost has been eliminated in the handling of coal, because the coal is fed directly from the coal bunker outside the boiler room.

The diagrammatic drawing shown below illustrates clearly how the Iron Fireman PS stokers function. The pictures at the left are actual views of the Pacolet Manufacturing Company boiler room.

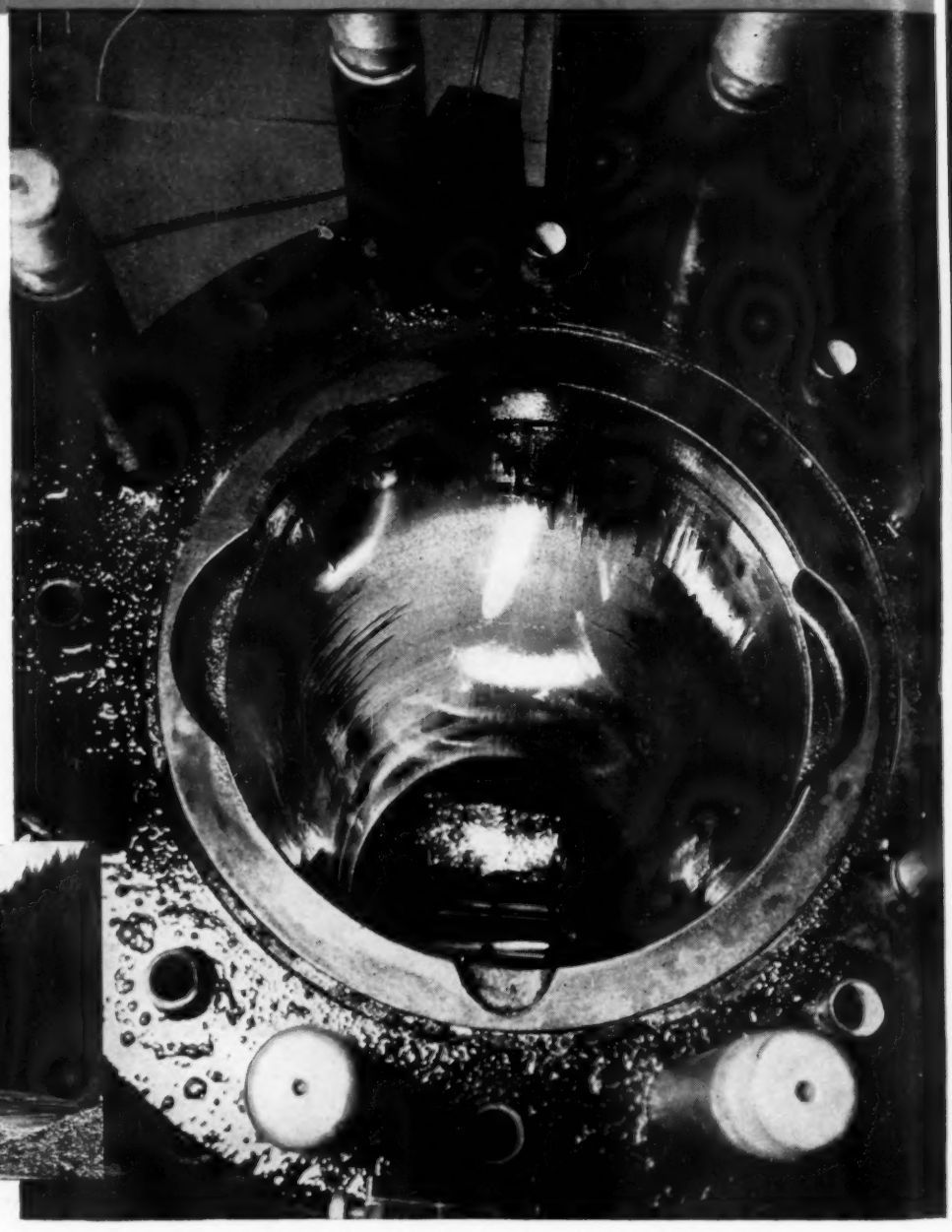
We ask that you, in the interest of fuel conservation and increased plant efficiency, as well as your own profits, give Iron Fireman an opportunity to show what can be done for you. Iron Fireman Manufacturing Co., Cleveland, Ohio; Portland, Oregon; Toronto, Canada. Write or wire 3349 W. 106th Street, Cleveland, Ohio.

# IRON FIREMAN

## Automatic Coal Stokers



# 10,595 HRS. WITH *these*



**LOOKING DOWN** cylinder of No. 3 Diesel just after piston was pulled for inspection. Note smooth, fine finish on walls, after 10,595 hours operation! Lubricant: *Texaco Ursa Oil,* of course.

(*Extreme right*)
Piston just as it appeared when removed from engine. All rings free, no hard carbon, no plugged oil ways. Out of 10,896 hours, engine had only 301 hours idle time. Always delivered full power.

(*Below*)
Boise King Placers' 7½ ft. bucket-type, electrically operated dredge at Twin Springs, Idaho. Power furnished by three 6-cyl. 4-cycle, 300 hp. Union Diesels, all lubricated with *Texaco Ursa Oils.*

TUNE IN FRED ALLEN EVERY SUNDAY NIGHT—CBS

TEXACO

# TEXACO

# Results

**FREE RINGS**

**NO VISIBLE CYLINDER WEAR**

**BEARING CONDITION—EXCELLENT**

**ENTIRE ENGINE CARBON-FREE**

DREDGING a river bed 80 miles back in the mountains, away from big city facilities, Boise King Placers depends upon uninterrupted power supply from its three 300-hp. Union Diesels . . . assures it by lubricating with *Texaco Ursa Oils.*

The excellent condition of the piston and cylinder shown here, after 10,595 hours steady operation, is typical of *Ursa's* performance. In addition to free rings and exceptionally low cylinder and bearing wear, Chief Engineer H. H. Crabb reports low oil consumption, sludge-free crankcases, complete absence of blow-by.

Because so many Diesel Operators enjoy similar results—

*More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.*

Texaco users enjoy many benefits that can also be yours. A Texaco Lubrication Engineer will gladly cooperate . . . just phone the nearest of more than 2300 Texaco distributing points in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York, N. Y.

**THEY PREFER TEXACO**

★More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★More locomotives and cars in the U. S. are lubricated with Texaco than with any other brand.

★More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

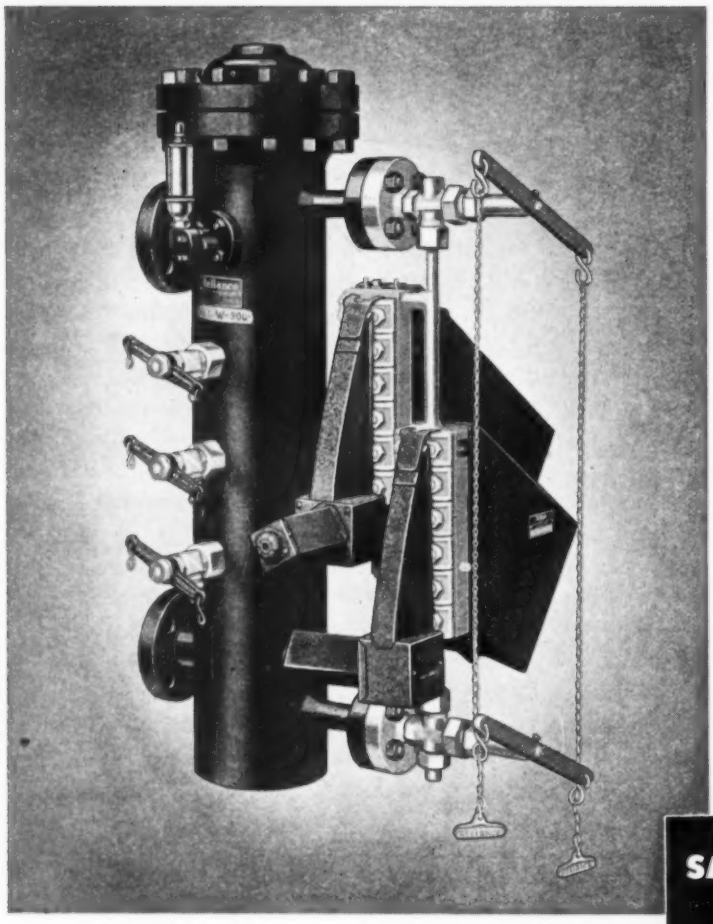
★More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

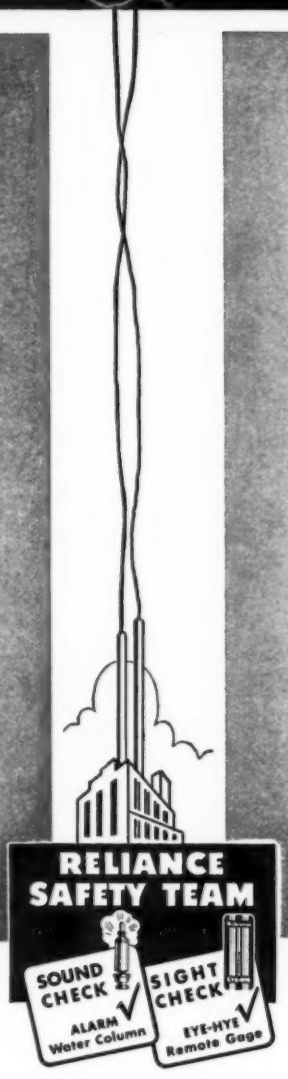
HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

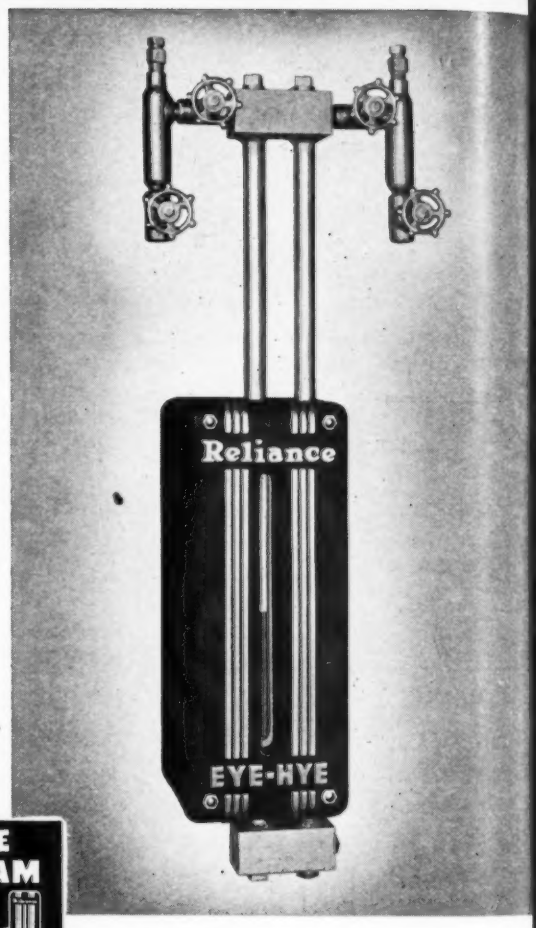
# Lubricants and Fuels

## FOR ALL POWER PLANT EQUIPMENT

# Don't let the power that turns in your plant fail because of






## Reliance ALARM Boiler Water Columns

Built and tested at pressures far above your specified working pressure, Reliance high and low water Alarms assure you years of unfailing service under all conditions. Made for pressures from zero to 900 pounds, with equipment engineered and built to match the load. Water columns for all higher pressures available without alarms.

## Reliance EYE-HYE Remote Reading Gage

Because EYE-HYE illumination is sharp, clear and highly visible, yet without material light spread, power plants in strategic areas are installing them for water level supervision during blackouts. Easily installed where you want them, regardless of boiler room obstacles.

Since 1884

TRADE MARK REG. IN U. S. PAT. OFF.

# Reliance

# the wheels of war production boiler water level accidents!

IF your boilers shut down, priceless time and vital fighting production are lost. *That must not happen!* But the risk of it is doubled and tripled over ordinary times. With full capacity loads and ceaseless day and night operation, the danger of something going wrong is multiplied. A water level accident now isn't merely embarrassing or costly. It may mean dangerous delay in delivery of needed materiels of war.

### Check Your Boiler Equipment Immediately!

Instruments, pumps, feed water regulators, controls of all kinds—including your water level alarms—make sure now that they are functioning perfectly. Maintenance priorities make replacement parts immediately available—order them now—take no chances.

If yours are among the hundreds of thousands of boilers equipped with Reliance water level Alarms, check them at once. We are shipping parts—floats, rods, valves, etc.—promptly.

### Now's the Time to Double Your Guard!

In peace time many leading power engineers felt it paid to have the double supervision of Reliance high and low water alarms and EYE-HYE, that shows the exact water level bright green in a gage down on the boiler room floor, where it *has* to be seen. Now Defense has us working all-out producing these safety sentinels for hundreds of power plants on land and sea. We suggest you write for descriptive bulletins.

Yours is a big responsibility—to keep power flowing. Don't take chances . . . check and re-check, now.

**THE RELIANCE GAUGE COLUMN COMPANY**
**5902 CARNEGIE AVENUE • CLEVELAND, OHIO**

## Reliance Representatives

are located in principal cities of the United States of America and welcome the opportunity to help you with your problems of boiler water level supervision.

**ATLANTA, GA.**
Spotswood R. Parker, 313 Bona Allen Bldg.
**BIRMINGHAM, ALA.**
Eshelman & Potter, Martin Bldg.
**BOSTON, MASS.**
Cochrane Steam Specialty Co.,
80 Federal St.
**BUFFALO, N. Y.**
The Stone Co.,
295 Hartford Road, Kenmore, N. Y.
**CHARLOTTE, N. C.**
Chas. M. Setzer & Co., Box 1867
**CHICAGO, ILL.**
W. P. Nevins Co., 53 W. Jackson Blvd.
**CINCINNATI, OHIO**
Charles M. Chapman, 815 Schmidt Bldg.
**DENVER, COLO.**
Joy & Cox, Inc., 1940 Blake St.
**DETROIT, MICH.**
Garrett Burgess, Inc., 5050 Joy Rd.
**HOUSTON, TEXAS**
Howard T. Ricley, Lamar Annex
**INDIANAPOLIS, IND.**
DeHaven Engineering Co., 115 N. Penn. St.
**LOS ANGELES, CAL.**
Warren & Bailey Co., 350 S. Anderson St.
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Geo. H. Fredricks & Co.,
647 W. Virginia St.
**MINNEAPOLIS, MINN.**
Bell & Eiss, Inc., Foshay Tower
**MONTREAL, QUEBEC, CANADA**
Lytle Engineering Specialties,
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**NEW ORLEANS, LA.**
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Economy Equipment Co., 4526 Olive St.
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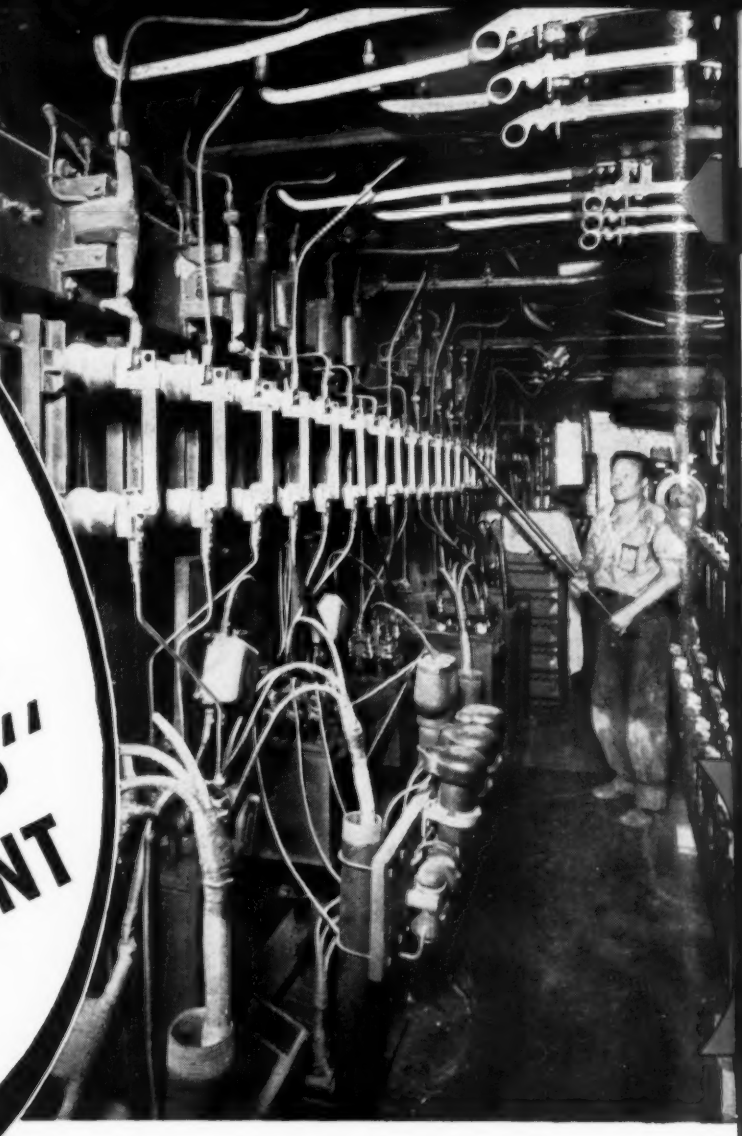
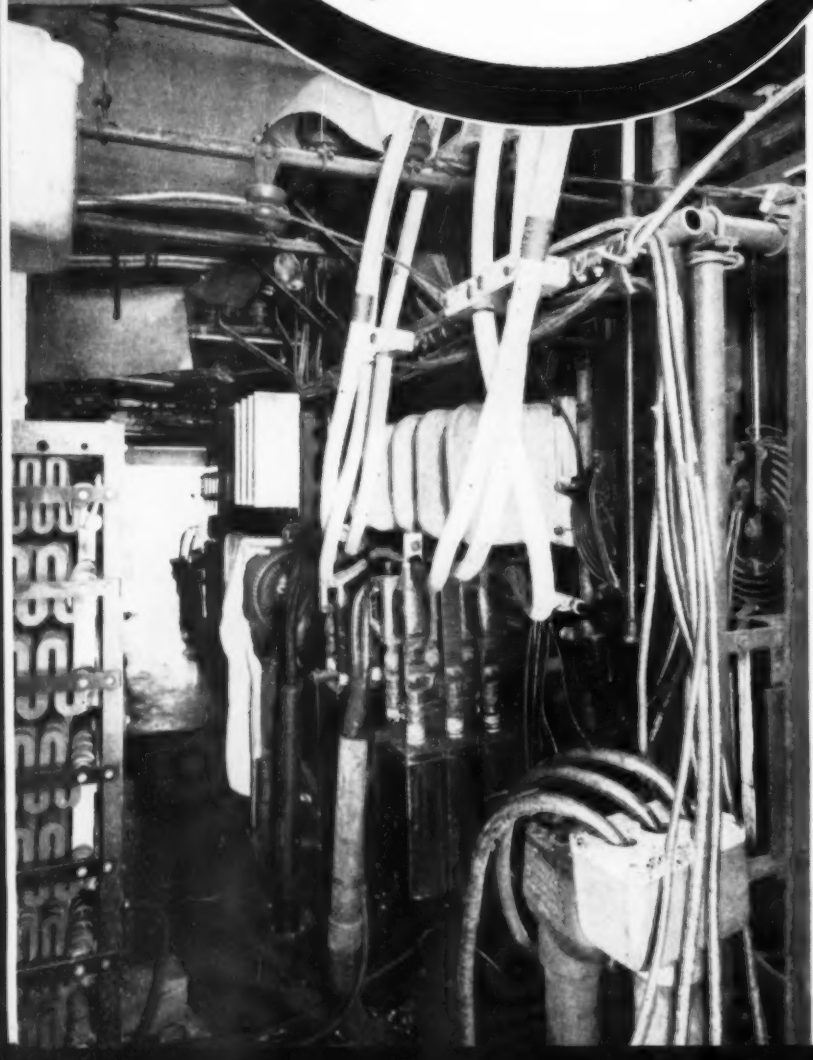
**WASHINGTON, D. C.**
Meleney Engineering Co., Mills Bldg.

# BOILER SAFETY DEVICES

# Watch Out

## FOR "LIVE-WIRE ENTANGLEMENTS" IN YOUR PLANT





## PROTECT PERSONNEL AND PRODUCTION WITH . . .

### *Safety-enclosed Switchgear*

DANGEROUS "spiderweb switchgear" like this originates as strung-out, open-type switchgear, and grows more dense and more dangerous every year that additional devices are added. It often adds up to power interruptions and accidents to personnel.

That's why compact, safety-enclosed switchgear is going not only into today's new and enlarged plants but also into scores of existent plants to replace exposed, open-type assemblies. Industry knows that its job is far too big—and its man power too precious—to trust in haphazardly exposed devices.

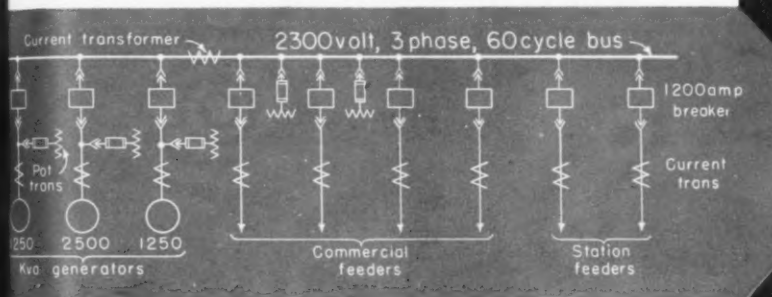
Today you can select, order, and install safety-enclosed switchgear in less time than ever before, because General Electric has *standards* to fill your needs. Standard load center unit substations, too, consisting of *metal-enclosed* switchgear and *Pyranol* transformers. Scores of war plants have kept in step with swelling power needs by installing these safe, compact, factory-assembled units instead of dangerous open-type assemblies. They give you long-term safety and dependability—save tons of vital copper.

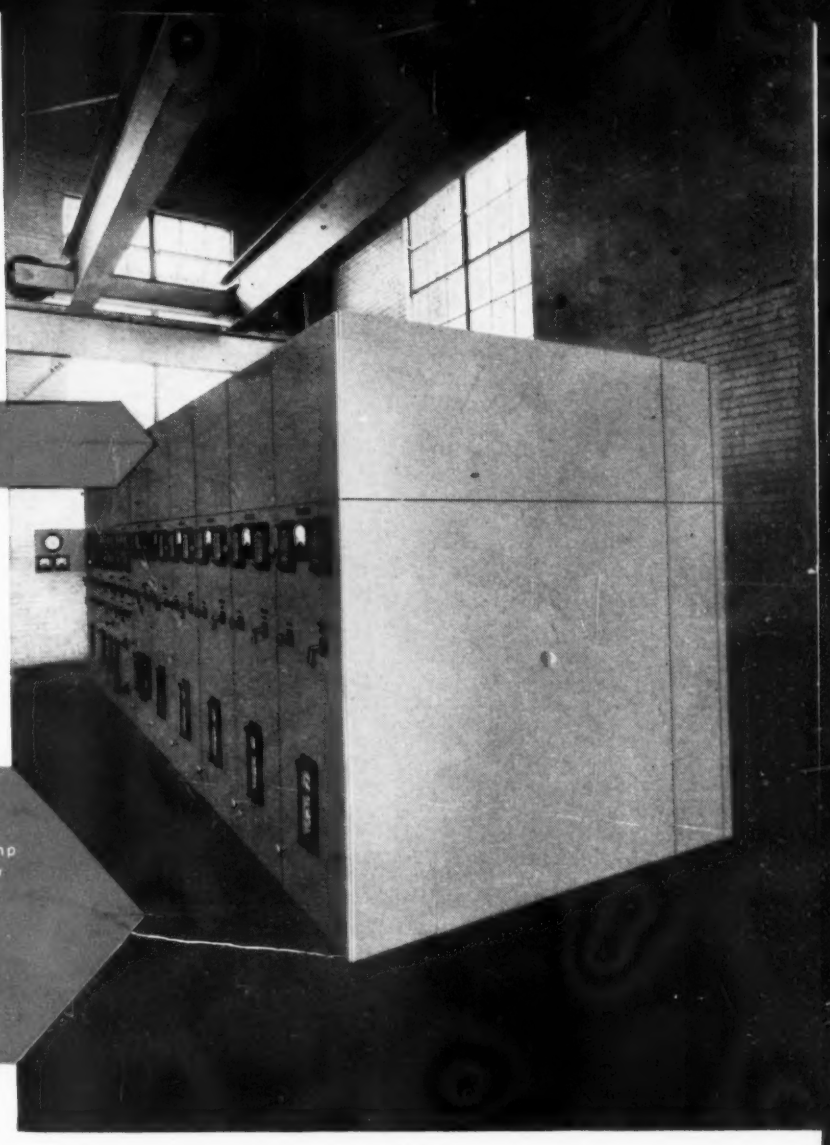
# THIS DANGEROUS AISLE LINED WITH LIVE COPPER WAS WIPED OUT . . . .

# . . . WHEN THIS MODERN SAFETY-ENCLOSED SWITCHGEAR WENT IN

**. . . because metal-clad includes breakers and all associated equipment—instrument transformers, buses, and connections—in one safe, compact "package."**

**This simple, one-line diagram enabled us to put our switchgear factory right to work on the safety-enclosed units shown at the right.**

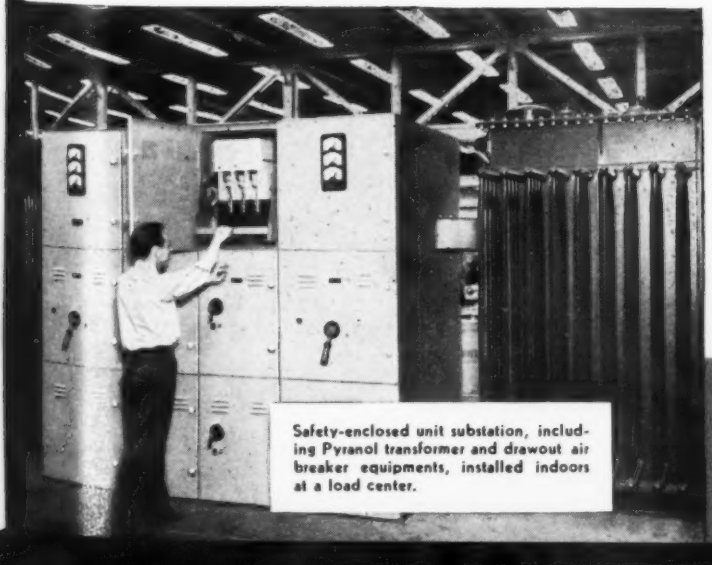


## SAFETY-ENCLOSED UNITS LIKE THESE CAN BE INSTALLED . . . *QUICKLY*

With the one-line diagram of the electric system, General Electric engineers helped select *standard* switchgear that filled every requirement. It took a relatively short time to manufacture the standard units. They were shipped complete—on arrival, they had only to be set in place and connected.

The modern metal-clad switchgear with vertical-lift breakers took over the load, the old open-type apparatus was removed, and power was continued without interruption.



Safety-enclosed unit substation, including Pyranol transformer and drawout air breaker equipments, installed indoors at a load center.

## . . . AND WITH TONS LESS COPPER

These metal-clad switchgear units took only 47 pounds of copper each—less than one-fourth as much as open-type assemblies for the same job. This is because compact, metal-clad construction does away with the many long, strung-out copper interconnections of open-type switchgear—replaces them with a few short ones. Also because copper disconnecting switches like those on the opposite page are entirely eliminated by modern, vertical-lift breakers that can be quickly and easily connected and disconnected from the main buses.

### Unit Subs Save Still More Copper

What's more, you can save immense amounts of cable copper by installing safety-enclosed unit substations—including *metal-enclosed* switchgear and *Pyranol* transformers—right at the center of the load area. Power can then be distributed to load centers at relatively high voltage. This means *short* secondary cables—and tons of copper saved.

Ask the nearest G-E office about *standard* G-E switchgear and unit substations. You can save time and copper, and get a new high degree of operating dependability and safety. ***General Electric, Schenectady, N. Y.***

*The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in six plants manufacturing naval equipment.*

**GENERAL ELECTRIC**

354-81-1800

# In Iowa - Where the Tall Corn Grows

## YARWAY CYLINDER-GUIDED EXPANSION JOINTS

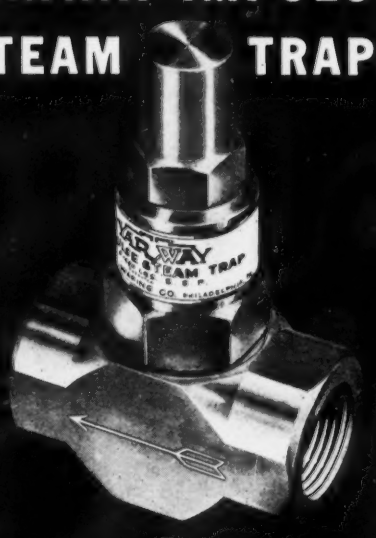
Welded Wrought Steel. Single and double types with flanged or welding ends. Small diameter—no large tunnel space required. Made in two types—the conventional Gland-Pakt type and the revolutionary Gun-Pakt type which permits packing under full steam pressure. Catalog EJ-1908.

## YARWAY SEATLESS BLOW-OFF VALVES

Yarway Seatless Blow-Off Valves have been proved by a generation of satisfactory service in more than 12,000 plants. No seat to score, wear and clog with mud, scale and dirt. Write for Catalog B-422 for pressures up to 400 lbs; B-431 for higher pressures.

# Yarway Products Help Make Corn Products in the Great Plant of Penick and Ford, Inc.

## YARWAY IMPULSE STEAM TRAPS



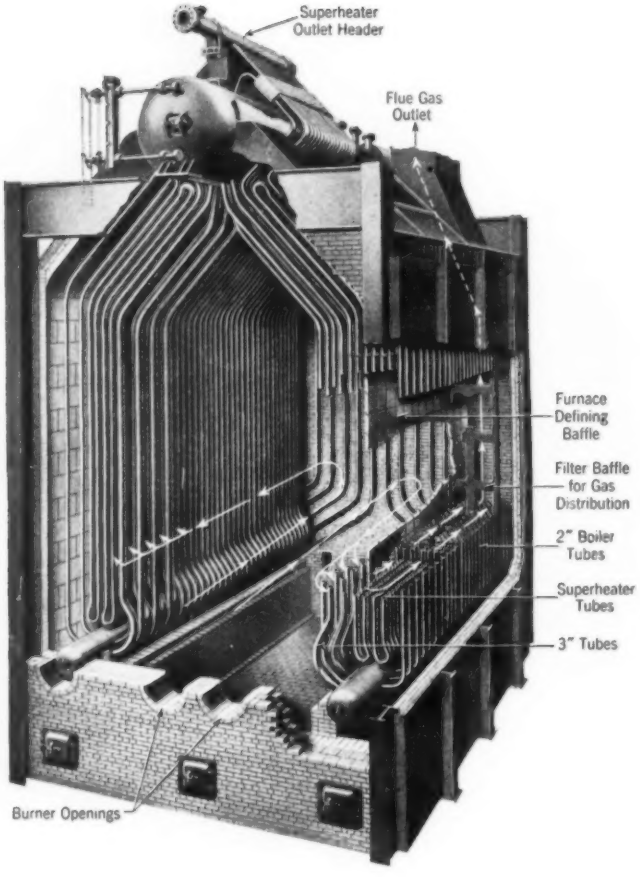
Insure quick heating and greater sustained heating efficiency. Light in weight. Small size. Low price. Easily installed and serviced. Operate on exclusive *Impulse* principle. Six sizes serve practically all requirements. Send for Catalog T-1737

YARWAY

YARNALL-WARING CO., PHILADELPHIA

# 50 more "S-A" BOILERS for INDUSTRY

Fifty "S-A" power plant boilers are now under construction . . . evidence of their unusual fitness for war's most urgent power requirement—"maximum steam from minimum materials".




Characteristics of units on these various orders include:—

***Capacities***——from 15,000 to 200,000 lb. of steam per hour

***Pressures***——to 650 lb. per square inch

***Final Steam Temperatures***—to 740° F.

***Fuels***——Pulverized Coal
Oil
Refinery Gas
Oil or Gas
Also dual firing of gas and coal

The Army-Navy Production "E" has been awarded to Foster Wheeler in recognition of quality equipment, in quantity, on time.

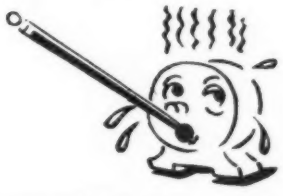
FOSTER WHEELER CORPORATION, 165 Broadway, New York

FOSTER WHEELER

# Plan for a Long War— Work for a Short One!

**No one can say how long this war will last. But maintenance can say how long America's *motors* will last... and how efficiently they will work to help *shorten* the war!**

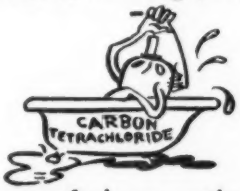
MAINTENANCE "as usual" went out with Pearl Harbor. Today, every U. S. maintenance man knows he's pitted against a Jap or Nazi maintenance man. He's got a man-sized job...



For example, if the current in a motor exceeds its nameplate current rating, heating may increase as much as the *square* of the current increase! And when a motor runs a fever, there's trouble ahead...

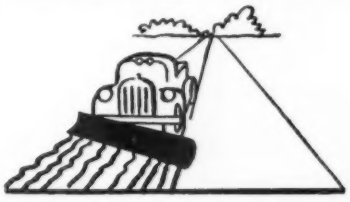
Excessive heat can "fry" the life out of insulation, melt soldered connections, burn out bearings. That's why a close eye must be kept on every motor's overload protection.

Friction is another dangerous source of heat — so the right lubricant in the right amount must be kept *in* bearings and dust must be kept *out!* For cool-running motors, dust must be kept out of *windings*, too...




If compressed air or suction doesn't get the dust out, it's necessary to give the dirty motor a "bath". *Promptly*, too — because the rim travel of a rotor in many motors today is round the world *every eight days*...

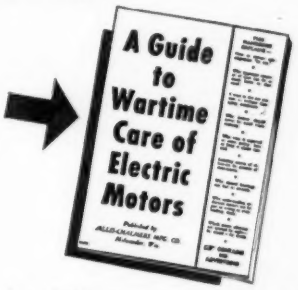
Some job to keep motors rolling at that rate — for the duration!



Just as "rutting" is fought in road maintenance, "grooving" must be fought in *motor* maintenance. Some wear is inevitable on slip rings and commutators, of course. But *smooth and even* wear is *slow* wear!

"Keep oil where it belongs" is a basic rule in maintenance. Once outside bearings, it attacks any insulation it reaches. *Inside* bearings, oil must be protected against misalignment pressures...

The oil film guarding a bearing often is no thicker than the wall of a soap bubble... can fail just as suddenly — *and completely!*




For the full story of what *today's* maintenance should be, send for your free copy of "A Guide to Wartime Care of Electric Motors." It's fully illustrated (with the sketches above and many more), practical, complete. ALLIS-CHALMERS MFG. CO., MILWAUKEE, WISCONSIN.

A 1553

**ALLIS-CHALMERS**

WE WORK FOR VICTORY — WE PLAN FOR PEACE

# HE READS THE *"Life-lines"* OF GLOBE PRESSURE TUBES

The life expectancy of a Globe Pressure Tube is an open book to the Globe metallurgist. Frequent laboratory tests, including photomicrographic inspection, in addition to careful and thorough individual gauging for wall thickness and outside diameter, insure a consistently uniform quality of product.

Such extra precautions in manufacture may readily be translated into longer life and greater safety in use. This extra margin of safety and strength means lower cost in the long run for the user of Globe Pressure Tubes.

*Globe Engineers are always available to assist in selecting a tube with the exact characteristic you require.*

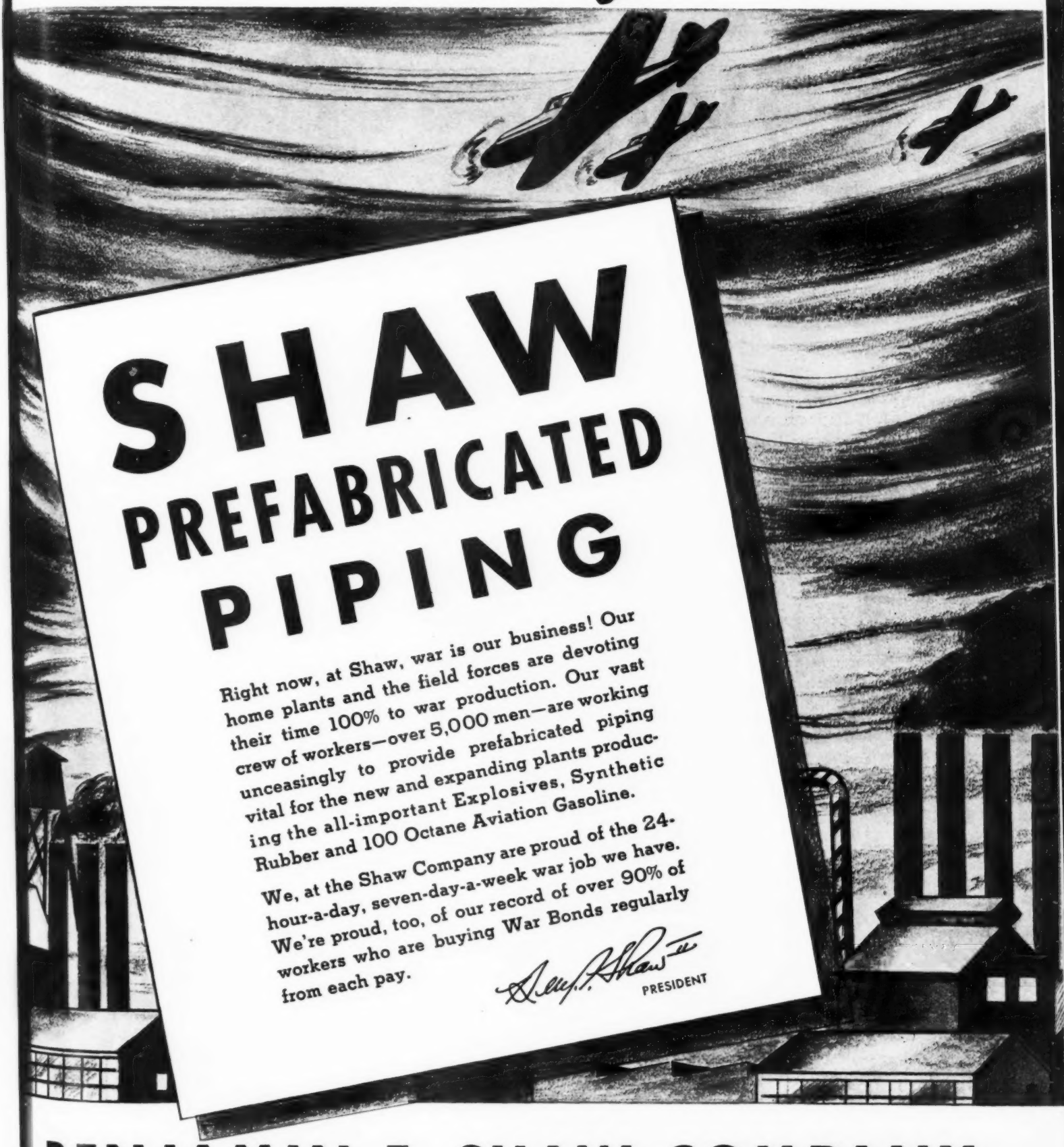
**GLOBE STEEL TUBES CO., Milwaukee, Wis.**

STAINLESS TUBES
BOILER TUBES
CONDENSER AND HEAT EXCHANGER TUBES
MECHANICAL TUBING

**GLOBE STEEL *Tubes***

GLOBE TUBES

# Doing an all-out War-Time job . . .



# SHAW PREFABRICATED PIPING

Right now, at Shaw, war is our business! Our home plants and the field forces are devoting their time 100% to war production. Our vast crew of workers—over 5,000 men—are working unceasingly to provide prefabricated piping vital for the new and expanding plants producing the all-important Explosives, Synthetic Rubber and 100 Octane Aviation Gasoline.

We, at the Shaw Company are proud of the 24-hour-a-day, seven-day-a-week war job we have. We're proud, too, of our record of over 90% of workers who are buying War Bonds regularly from each pay.

Benj. F. Shaw III
PRESIDENT

## BENJAMIN F. SHAW COMPANY

2nd & Lombard Streets, Wilmington, Delaware

PIPING FABRICATORS AND CONTRACTORS

# A Statement by CYRUS Wm. RICE

● It is well known that Dissolved Calcium in concentrated boiler waters under steaming conditions is the primary cause for scale formations, principally of the sulphate type.

Tests that establish the low treatment or treatment combinations for keeping these waters calcium-free are, therefore, fundamentally basic in conditioning boilers against scale deposits. Tests for this work were developed over 10 years prior to 1912 through studies of the available literature and of many analyses of water softener products and boiler blow-downs. They were brought to the general attention of the engineer when a cabinet carrying complete instructions was first advertised in "Power" in 1918. This included the simplest kind of tests for use of the plant operators having no knowledge of chemistry. It provided only for the purchase, use, and control of commercial chemicals with their much lower costs. Also, included recommendations for substituting trisodium phosphate for caustic soda and soda ash, together with Tables and Factors as aids to the engineer for making adjustments in these changes.

Once the minimum treatment or treatment combinations for a blow-down water were determined for a specific condition, it then only became a matter of setting the top range for control purposes and in testing concentrates periodically for holding these treatments between the minimum and top limits. This was largely a matter of judgment, developed principally through every-day treating experiences.

Another development included in the cabinet instructions was the test for controlling blow-downs. This was based on the influence, over-boiler-salt concentrations had on dirty steam. It was the first tests of this kind for controlling the boiler blow-downs and steam quality on a scientific basis.

These tests were all new and of major importance with wide economic influences on treating costs, boiler and turbine repairs, and efficiencies. They were all copyrighted and records should, therefore, be on file in the Library of Congress.

***In the years since 1918, these basic fundamental controls for scale prevention and of blow-downs, including chlorides and sulphates, have found universal use. Other than refinements in the tests in use for these purposes, the practices originated by the author, remain the same.***

In 1935, further studies were started toward developing an inexpensive phosphate treatment with combined properties for maintaining calcium-free waters, equally with silica scale and sludge, the growing major problem in the high temperature boiler operations.

★ ★ ★

# Good Water Conditioning"

## *The culmination of this work today is*

# PHOSCALOID

A patented product resulting through the reaction of strong Phosphoric Acid on Proteins of the Class in use for making plastics. The effect of this is to convert a protein that is naturally insoluble in water into one having highly diffusible properties, and highly reactive to calcium. In fact, records for a period of years prove this calcium reactive property of Protein to be more than twice as effective as phosphates in which pound for pound Phoscaloid maintains the same $PO_4$ concentrations as soda phosphates containing better than 50% more $P_2O_5$ and costing two and three times as much. The organic-inorganic products resulting through this use of Phoscaloid are also most effective in preventing silica sludge and scale accumulations in the boiler. This is being constantly proven in every-day operations in many plants where the time beween shut-downs for cleaning boilers has been increased many hundred per cent.

Being liquid, Phoscaloid is fed without dilution and frequently from the shipping container itself, through pipes, pumps, and heaters without fear of phosphate depositions and corrosion, thus eliminating the troublesome practice of handling, weighing, and dissolving chemicals. In fact, the automatic feeding set-up developed for its use allows for as little as a single feed into either the suction or discharge of a pump to a number of boilers or boiler houses and with an apportionment in phosphates among the units that is almost unbelievable. This eliminates the individual lines to each boiler with their numerous connections and repairs at costs for automatic feeders for as low as $100.00.

## **PHOSCALOID** *is also of great value as an After-Treatment in the operation of LIME-SODA or ZEOLITE Softeners*

This is because it contains no free soda, introduces none to softener products, which are so often over-burdened in this way, but does reduce excess sodas in these same softened waters to a greater degree than any other conditioning agent, thus diminishing the effect of these excesses on carry-overs, embrittlement, etc.

Combined with soda ash and caustic soda, Phoscaloid will make any one or more of the commercial soda phosphates for meeting any difficult water conditions. This, with its lime-precipitating colloids, provides some of the most effective economical combinations for keeping boilers clean and free from silica sludge and scale.

***This combination of Phoscaloid with commercial sodas is another economic feature in eliminating the necessity for purchasing, weighing and diluting separate soda phosphates in the conditioning practices.***

Studies for determining other values are being carried out, but according to the excellent records following the use of this chemical under the severest kind of water and operating conditions, Phoscaloid is another major development that will finally be recognized universally as such.

This is no idler's conclusion as Phoscaloid combines the practical experience of 40 years in the solution of many hundreds of problems with commercial chemicals of known value under scientific control only and with the one objective of doing the best for the clients we serve.

***No power plant should be without the booklet, "Silica vs Phoscaloid" as illustrated here. Here is a treatise on this all-important subject, not only written in a distinctive style, but reviews the history of feed water treatment development from pioneer days to the present time.***

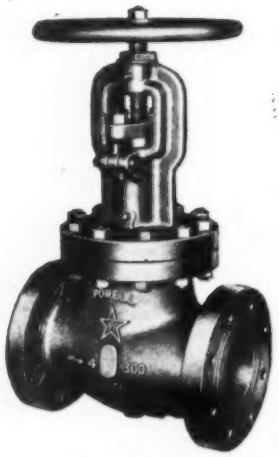
***A copy will be sent to any power field executive, engineer or boiler room foreman, on request.***

# & Company, Inc., Pittsburgh, Pa.

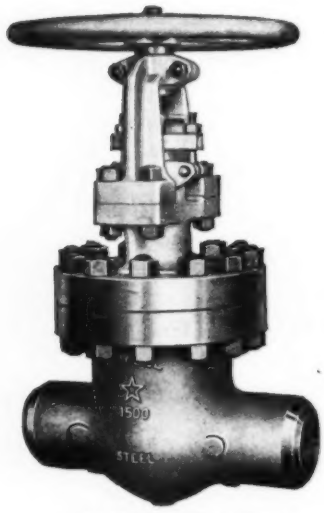
# POWELL *Steel* VALVES

## There's a Powell Cast Steel Valve for Every Pressure from

# 150 to 2500 Pounds W. S. P.



Class 300-pound Flanged End O. S. & Y. Globe Valve

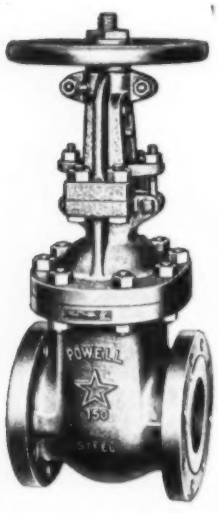


Class 1500-pound Welding End O. S. & Y. Gate Valve

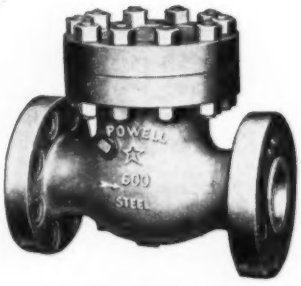
Year in and year out, through nearly a century of industrial progress, Powell has always kept in step with the ever-quickening march of time.

In recent years the demands for power and more power, with the corresponding necessity for valve control at vastly increased pressures and higher and higher temperatures, has necessitated valves that can really "take it."

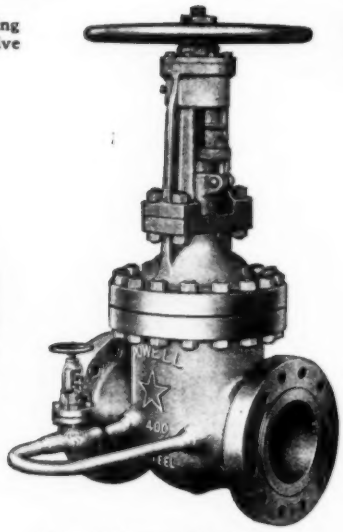
Powell has met this challenge with a complete line of cast steel valves that are daily satisfying the most exacting requirements in the power field.



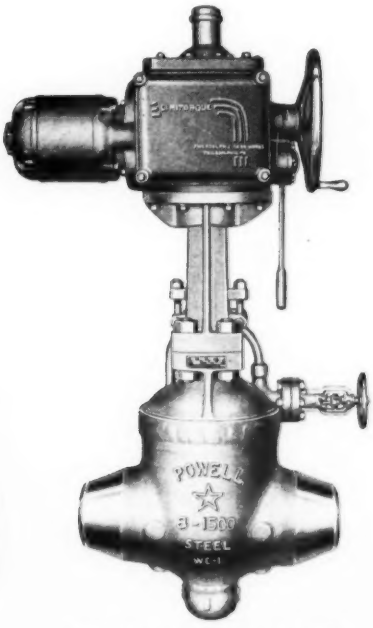
Class 150-pound Flanged End O. S. & Y. Gate Valve



Class 600-pound Flanged End Swing Check Valve



Class 400-pound Flanged End Gate Valve with By-pass



Class 1500-pound Motor Operated Gate Valve with Welded Bonnet and Special By-pass

# POWELL

# for POWER PLANTS

## The Powell Line of Cast Steel Valves includes GLOBE, ANGLE, GATE, CHECK, NON-RETURN, HAND, GEAR, and MOTOR OPERATED VALVES

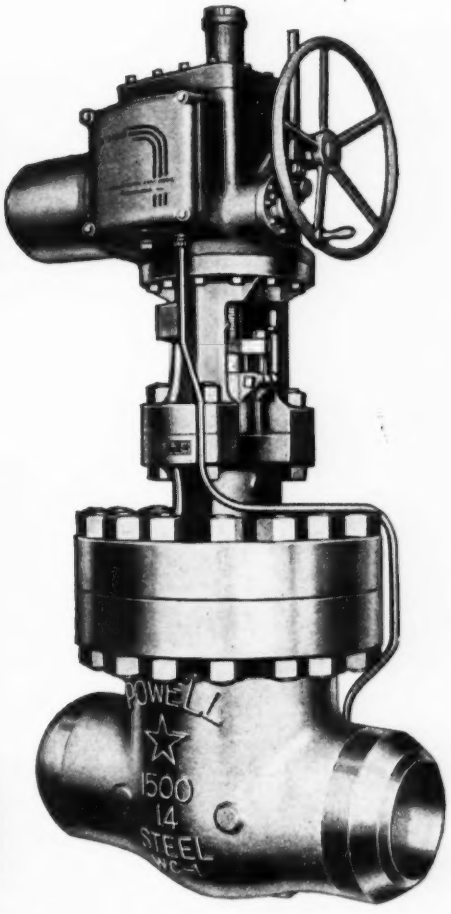
If you have any valve problems in your power plant, the Powell Engineering staff is ready and willing at all times to help you solve them.

**The Wm. Powell Co.**

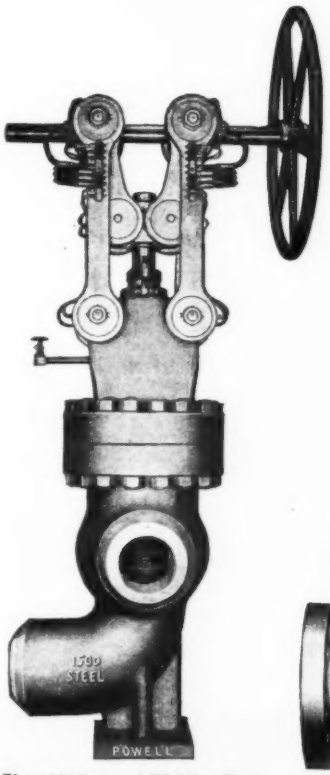
***Dependable Valves since 1846***

**Cincinnati, Ohio**

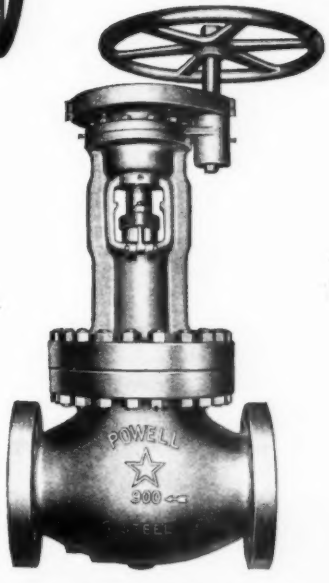
Class 900-pound Flanged End Lift Check Valve



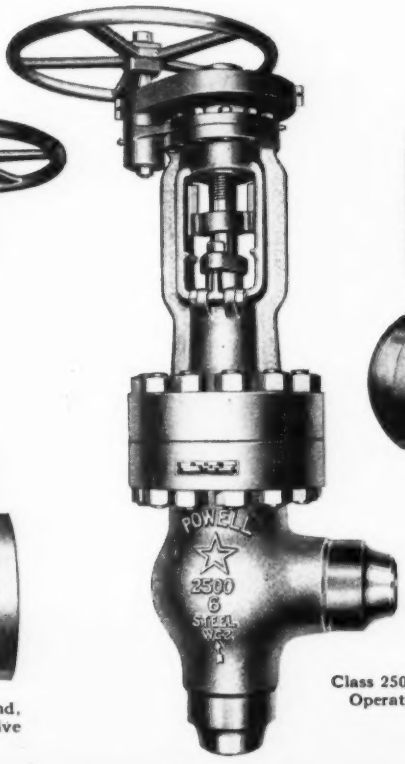

Class 1500-pound, 14" Welding End Gate with Top-Mounted Motor Operator




Class 1500-pound Welding End, Toggle Operated Non-return Angle Valve



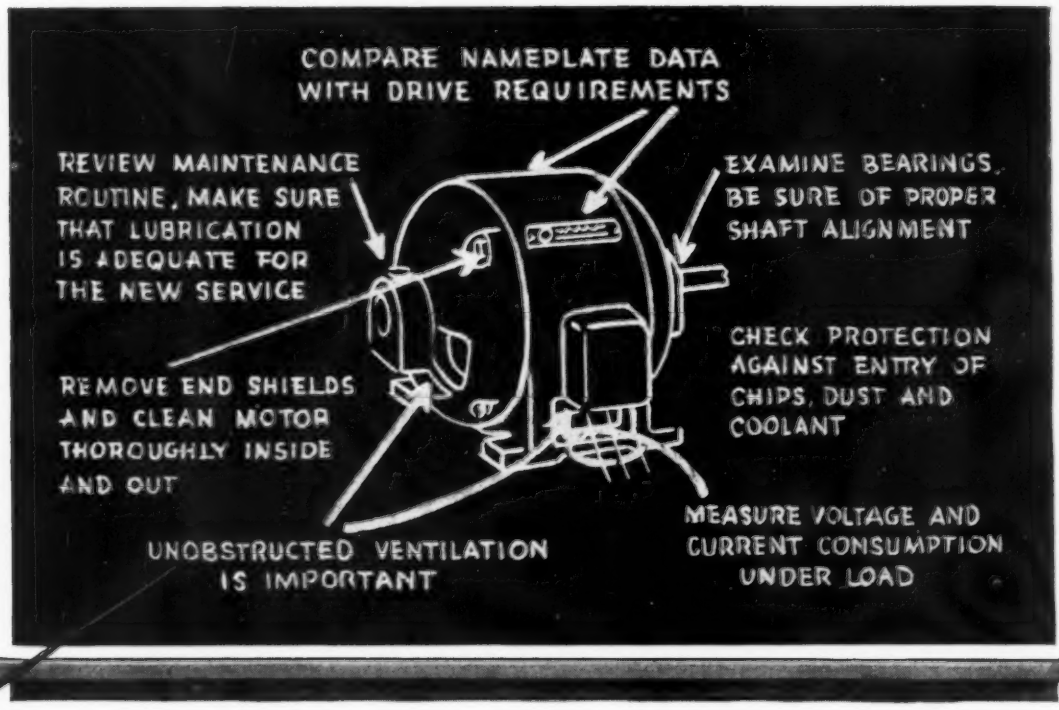

Class 900-pound Flanged End, Gear Operated Non-return Valve




Class 2500-pound Welding End, Gear Operated O. S. & Y. Angle Valve

# VALVES

# *it's time to be a crank about*


COMPARE NAMEPLATE DATA WITH DRIVE REQUIREMENTS
REVIEW MAINTENANCE ROUTINE, MAKE SURE THAT LUBRICATION IS ADEQUATE FOR THE NEW SERVICE
EXAMINE BEARINGS. BE SURE OF PROPER SHAFT ALIGNMENT
CHECK PROTECTION AGAINST ENTRY OF CHIPS, DUST AND COOLANT
REMOVE END SHIELDS AND CLEAN MOTOR THOROUGHLY INSIDE AND OUT
UNOBSTRUCTED VENTILATION IS IMPORTANT
MEASURE VOLTAGE AND CURRENT CONSUMPTION UNDER LOAD

### *protect your production with this maintenance plan*

*Planned* motor maintenance, keyed to today's loads and conditions, saves vital hours of production time by forestalling future breakdowns and delay. In replacing hit-or-miss motor servicing with a regular schedule of trouble-*prevention*, you'll find real help in G-E *Motor Fitness Manual.*

The check list (right) tells what to do. The *Manual* tells how to do it, using well-proved methods that save time and help assure long-lasting motor service.

And, of course, your local G-E Motor Representative is always ready to aid you in putting these suggestions into practice, or in getting the new motors you may need for essential wartime jobs.

**MOTOR FITNESS MANUAL**

. . . for plants converted to war production. Tells what to do to get the most out of motors, old or new. If you're undertaking new work on motor-equipped machines, if you're "switching" motors from one job to another, or equipping machines with new motors, you'll find this bookful of helpful motor facts will save you valuable time. Write for a copy.

General Electric, Sec: J750-152
Schenectady, N. Y.

Yes, send me a copy of "Motor Fitness Manual," GED-1017.

Name .....

Title .....

Company .....

Address .....

City ..... State .....

8030

# MOTOR CARE

## HERE'S WHAT TO DO!

**1.** Make sure that motors are selected to *match the job.* Install motors so they are properly aligned with the driven load and are easily accessible for regular inspection.

***The G-E Motor Fitness Manual tells how***

**2.** Keep motors free from dust and dirt. Establish a definite cleaning schedule.

***The G-E Motor Fitness Manual tells how***

**3.** Be sure that lubrication is frequent enough to take care of increased production. See that employees are instructed as to proper methods. Also guard against over-lubrication.

***The G-E Motor Fitness Manual tells how***

**4.** A general overhauling of hard-worked motors will add years to their life. If your motors haven't had an overhaul in the last year, try to arrange your production schedule to permit one as soon as possible.

***The G-E Motor Fitness Manual tells how***

***IF YOU NEED NEW MOTORS** for important war work, check with your G-E Motor Representative on how to get Tri-Clad motors quickly.*

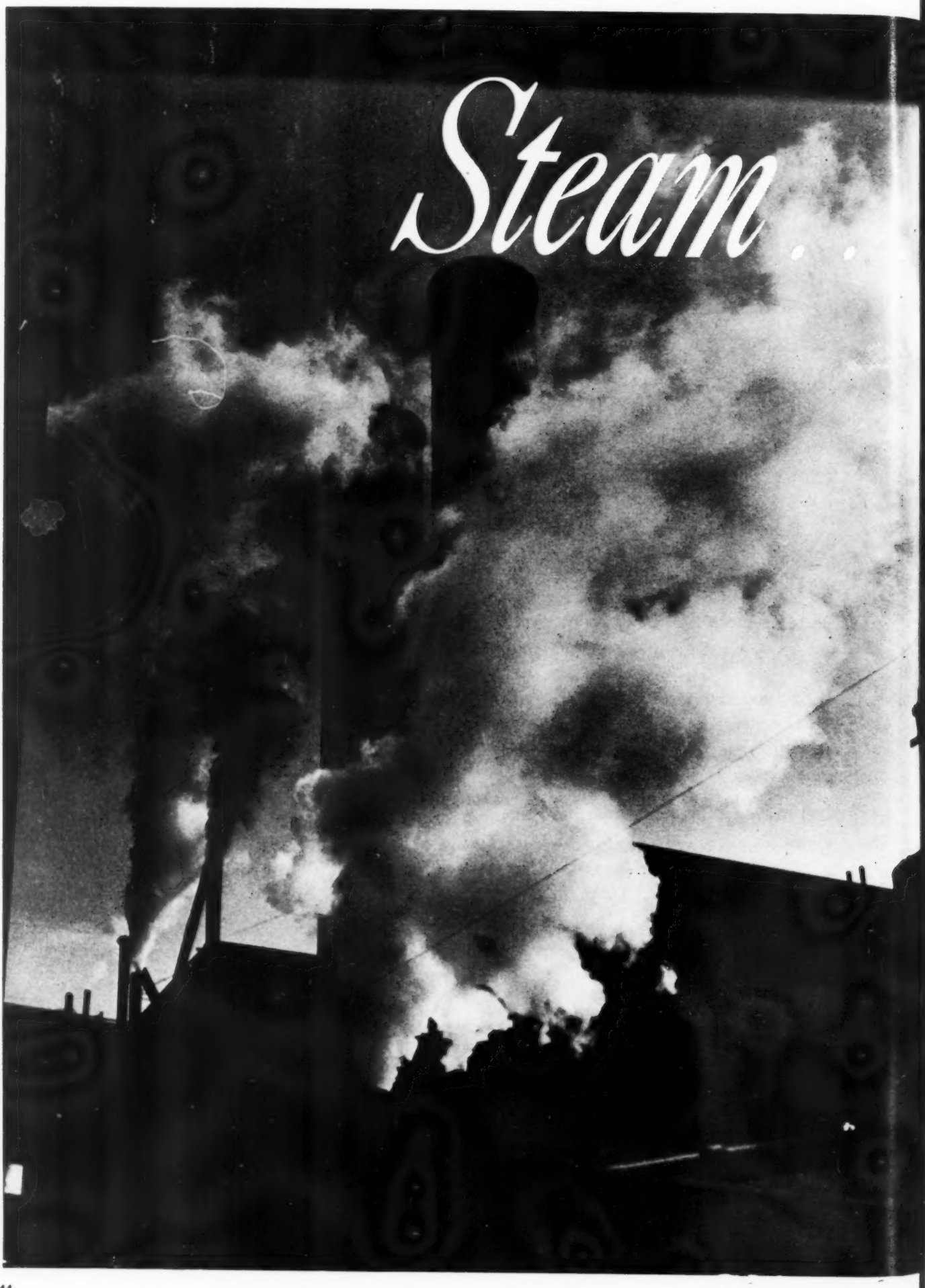
*The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in six plants manufacturing naval equipment.*

BUILDER OF

TRI CLAD MOTORS

REG. U.S. PAT. OFF.

# GENERAL ELECTRIC


Steam . . .

# the lifeblood of America's War Effort

***Here is how Hagan can help you <u>at once</u> to obtain maximum steam output***

OF all the advantages that Hagan Automatic Combustion Control offers you . . . increased efficiency, constant steam pressure, proper distribution of load among boilers . . . none is so important to you today as the fact that it assures you of *maximum steam output per pound of fuel.*

Regardless of other means of increasing boiler capacity, Hagan Control, of itself, will *increase steam output directly* by giving you:

**MAXIMUM QUANTITY** of steam from any given plant, by introducing fuel and air in correct proportion for utmost efficiency.

**MAXIMUM UTILIZATION** value, uniform steam pressure and temperature, in accordance with demand.

**MAXIMUM OUTPUT** from boilers of differing capacities, automatically.

**MAXIMUM STEAM** for production, by reducing loss of steam in frequent soot-blowing.

**MAXIMUM PROTECTION** of auxiliary equipment, fans, stokers, etc., by maintenance of uniform operating conditions.

The plant prepared for maximum efficiency today is the plant prepared for maximum economy tomorrow. Write or wire today for a Hagan engineer. He'll come at once.

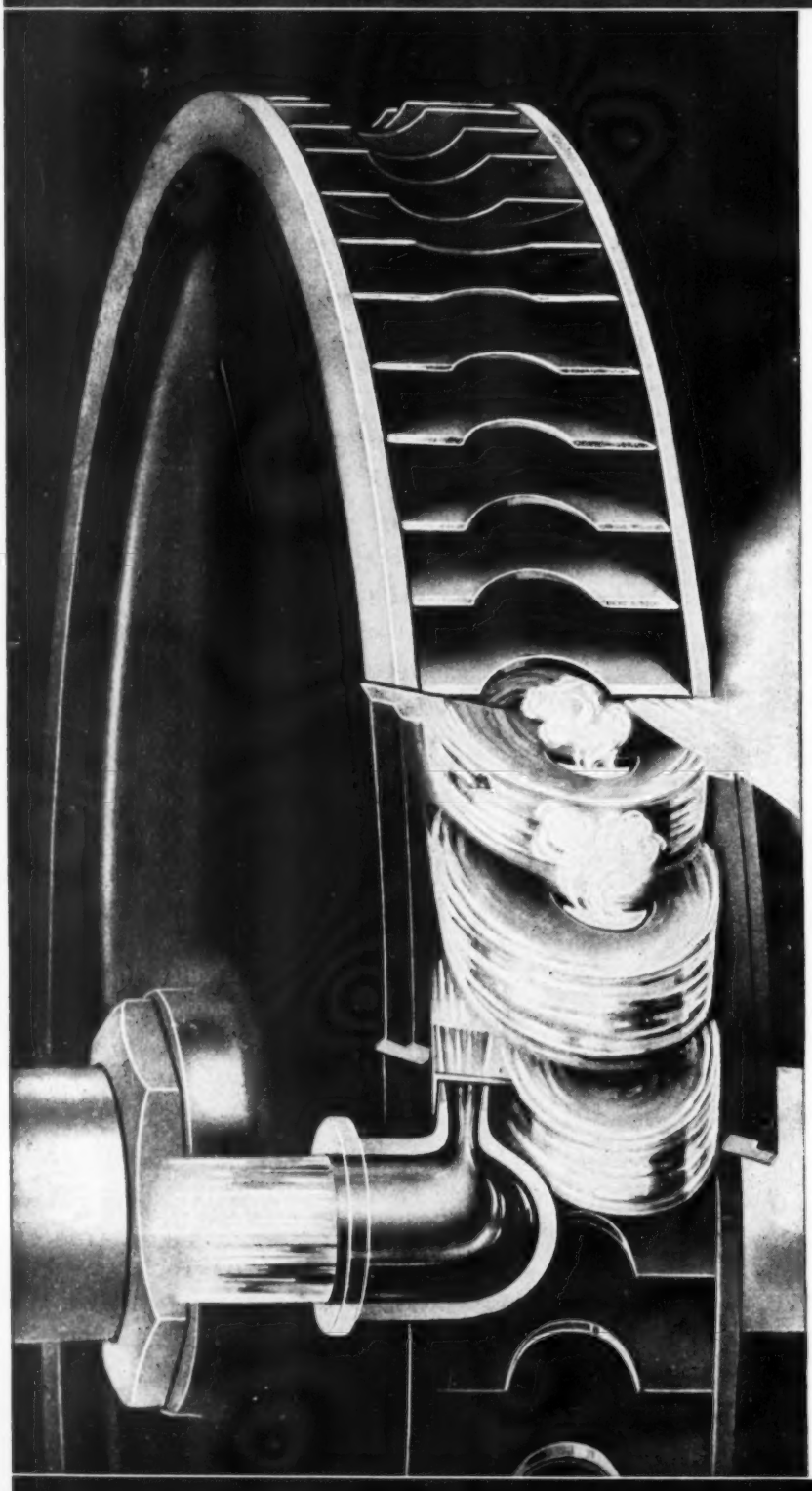
**HAGAN CORPORATION**
**HAGAN BUILDING**
**PITTSBURGH, PA.**

**SPECIFIC ADVANTAGES OF HAGAN AUTOMATIC COMBUSTION CONTROL**

Simplicity of operation.
Ease of installation.
Ruggedness of equipment.
Sensitivity to small load changes.
Accuracy of adjustments for small variations.
Speed of movement, with stability, throughout operating range.
Flexibility in meeting individual plant conditions.
Engineered by the pioneers and leaders in automatic combustion control.

**HAGAN *Automatic* COMBUSTION CONTROL**
*The pioneer . . . and still the leader*

# The TERRY



## RELIABILITY FIRST!

Throughout the entire forty-nine years that the Terry Turbine has been on the market it has always been the Terry policy to build first of all for reliability.

That this policy has been appreciated is proven by the very extensive use of Terry turbines where only the most trustworthy apparatus is permissible, namely in outstanding central stations, leading industrial plants and on large Naval vessels. The Terry today still maintains that preeminent position in these most exacting fields which it immediately took upon its introduction.

*At Left:—*

*Action of steam in Terry wheel turbine. The steam issues from an expanding nozzle at high velocity and enters the side of the wheel bucket in which its direction is reversed 180°. As this single reversal uses but a portion of the available energy, the steam is caught in a stationary reversing chamber and returned again to the wheel. This process is repeated several times until practically all of the useful energy has been utilized.*

THE TERRY STEAM TURBINE CO.

# Wheel Turbine

STEPS IN THE MACHINING OF A TERRY TURBINE WHEEL — From left to right:
1. Rough turned forging. 2. Smooth turned. 3. First milling cut. 4. Second milling cut. 5. Finished wheel.

## TERRY WHEEL TURBINE ADVANTAGES

— The blades and the wheel are in one piece so that there are no parts to become loose or work out.

— The blades have large clearances.

— The blades are double rim protected.

— End play will not damage the blading.

— It is impossible for the blades to foul.

— The power producing action of the steam in the wheel takes place on the curved surfaces at the back of the buckets and, therefore, close blade clearance is not necessary.

— The only function of the blades is to form a series of pockets, wear of the blade edges is of little consequence and does not materially affect the horse power or efficiency. The important part of the bucket is the back or bottom which is a solid forging.

— There is practically no end thrust since the steam enters and leaves the wheel in a direction at right angles to the shaft.

**ASK FOR BULLETIN S-116**

T-1143

**TERRY SQUARE - HARTFORD, CONN.**

Protect YOUR turbines with this oil that helps keep our

# BATTLEWAGONS BLASTING!

THE OIL that lubricates the powerful turbines aboard a battlewagon is as vital as the powder that sends the big 16-inch shells hurtling through space.

Entrusted with this important job aboard many battleships, aircraft carriers, destroyers, cruisers and other U. S. Naval units, is the new rust-preventive Shell Turbo Oil . . . lubricating not only heavily loaded main and thrust bearings but also reduction gears which must run at terrific rubbing speeds and under heavy pressures.

Shell Turbo Oil can survive these extreme operating conditions because it has *all 3* characteristics necessary to the proper lubrication of modern turbines:

**RUST PREVENTION**
**SUPERIOR OXIDATION STABILITY**
**MINIMUM FOAMING TENDENCY**

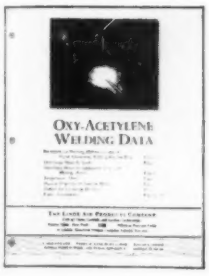
Call in the Shell man now for full details.

RUST-PREVENTIVE
SHELL TURBO OIL
A name to Remember

SHELL

# HELPFUL LITERATURE
## for Oxy-Acetylene Welding and Cutting Operators

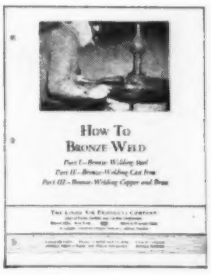
As part of our service to industry, the Linde organization makes available a library of oxy-acetylene process information. A partial list of this "how-to-do-it" literature is shown here. If you need copies of any of the booklets described, you can obtain them from any Linde office, without charge. Please ask for them by Form numbers.




### OXY-ACETYLENE WELDING DATA

*12 pages—Form 4600*

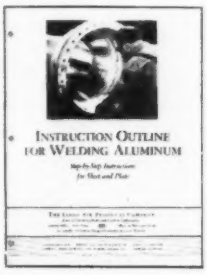
Charts, tables, and recommended welding methods; choice of flame adjustments, welding rod, and flux; methods for identifying metals; physical properties of familiar metals; temperature data chart; and a conversion table for hardness numbers are included in this booklet.




### HOW TO BRONZE-WELD

*16 pages—Form 4328*

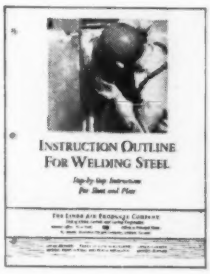
This booklet discusses the theory and advantages of bronze-welding, and describes by means of step-by-step pictures correct techniques for bronze-welding steel, cast iron, copper and brass. Bronze-welding and bronze-surfacing techniques are also shown in pictures of practical applications.




### INSTRUCTION OUTLINE FOR WELDING ALUMINUM

*8 pages—Form 4538*

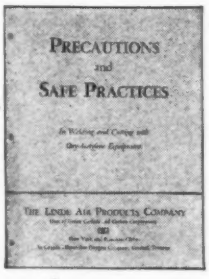
Instructions for welding aluminum sheet and plate, including the choice of proper flame and rod, the joint design, the use of jigs and supports, and cleaning and fluxing, are given in step-by-step illustrations. How the physical characteristics of aluminum affect welding technique is also discussed.




### INSTRUCTION OUTLINE FOR WELDING STEEL

*20 pages—Form 4645*

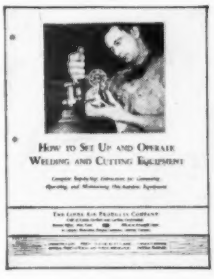
This is a series of practice exercises ranging from primary melting to making position butt welds in steel sheet and plate. Instructions for blowpipe manipulation and rod deposit, and examples of both good and poor welds, are included for guidance in correcting faulty procedure.




### PRECAUTIONS AND SAFE PRACTICES

*56 pages—Form 2035*

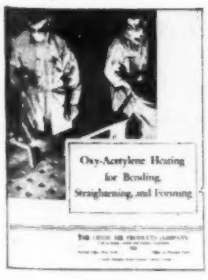
A copy of this booklet should be in the hands of every operator of oxy-acetylene welding and cutting equipment. It completely covers all the safety precautions that should be observed in setting up and operating equipment, in handling calcium carbide and oxygen and acetylene cylinders, and in maintaining equipment.




### HOW TO SET UP AND OPERATE WELDING AND CUTTING EQUIPMENT

*20 pages—Form 5165*

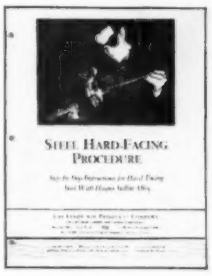
Complete, step-by-step illustrated instructions for connecting, operating, and maintaining oxy-acetylene welding and cutting equipment. A careful study of the various suggestions in this booklet will aid all operators in getting the most out of their equipment, and will help to promote safety.




### OXY-ACETYLENE HEATING FOR BENDING, STRAIGHTENING, AND FORMING

*8 pages—Form 4200*

The many applications of the oxy-acetylene flame for "smithing" operations, its use in automotive production and repair, in the boiler shop, and for upsetting and stretching, are reviewed. Three methods for straightening bent shafts are given.




### STEEL HARD-FACING PROCEDURE

*8 pages—Form 3491*

The special instructions given here, based on the general hard-facing procedures, should prove helpful to everyone applying Haynes Stellite alloy to steel surfaces. A chart of hard-facing materials data and a listing of suggested hard-facing applications are also included.

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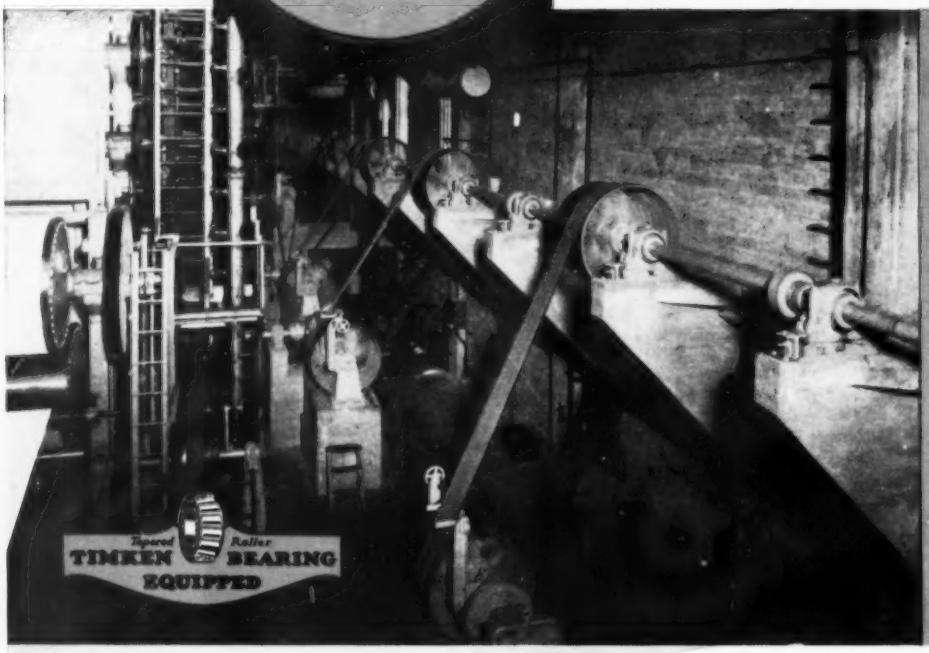


Dodge-Timken Pillow Blocks supporting line shaft driving pulp drying machine.

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# An Answer from the skies

"NO FOREIGN power can ever harm Germany from the air" was the boast of Hitler's air marshal. Yet today American planes, piloted by American airmen, are flying far into middle Europe, carrying loads of destruction to the mighty industrial plants—the huge utility system—the network of transportation lines that are all so vital to the Third Reich's military power.

This sky-borne answer to Goering's boast is dramatic proof of the quality of American planes—and the American engines that power them.

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That this problem was successfully solved is evidenced by the gears—thousands upon thousands of them—being daily turned out by the Precision Gear Plant of Foote Bros.—gears produced on a schedule that spells doom for the Axis ambition of world conquest.

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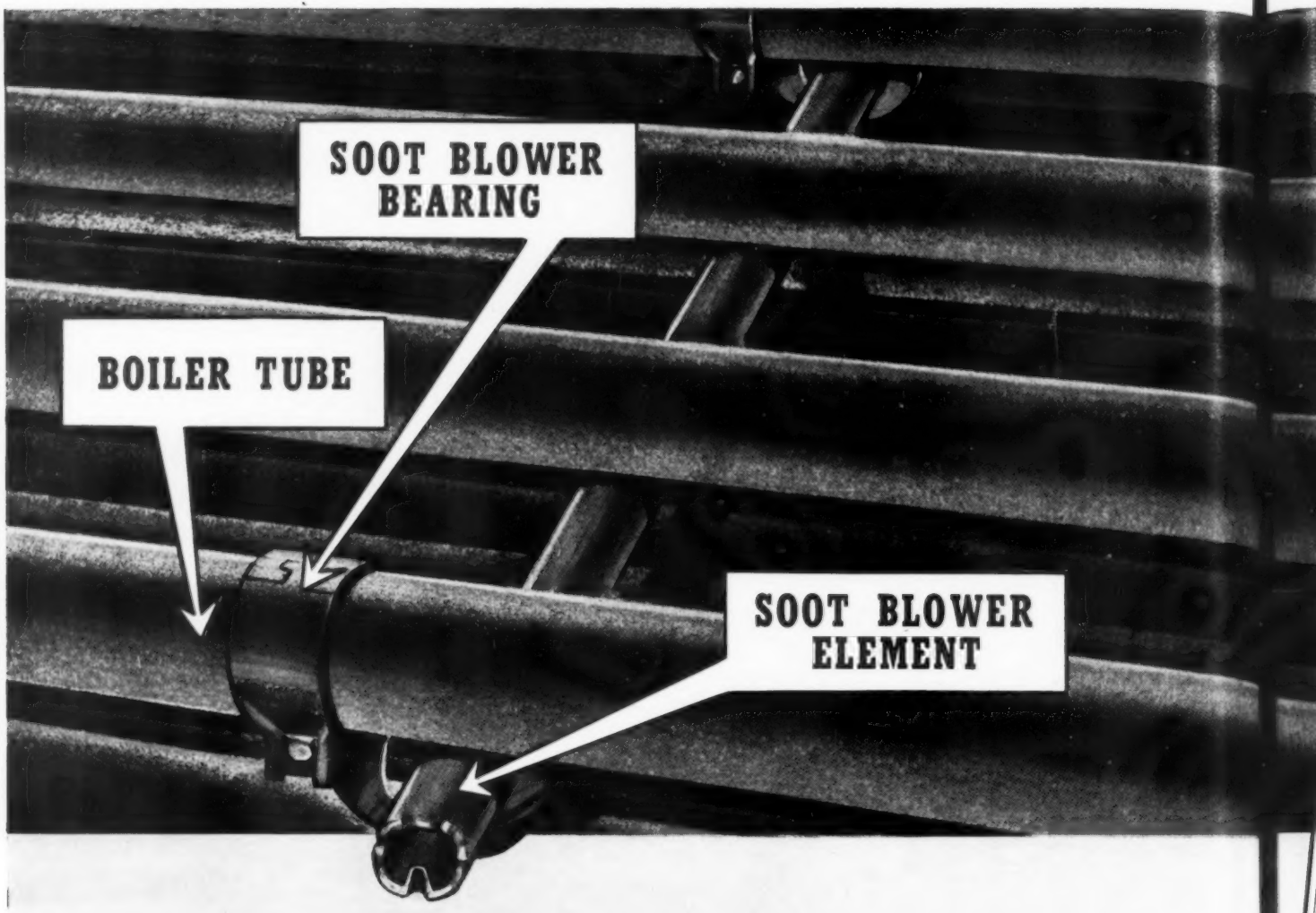
*Better Power Transmission Through Better Gears*




*for better boiler cleaning and*
*longer blower element life . . .*

# KEEP YOUR SOOT BLOWER BEARINGS LINED UP

DIAMOND POWER SPECIALTY CORP.
DETROIT, MICHIGAN

HEAVY demands upon the Diamond organization for war needs often make it difficult for us to supply new soot blowers, or to supply repair parts as promptly as we would like. It is important to make the soot blowers you have give service as long as possible. Careful maintenance will prolong their usefulness, keep them efficient.

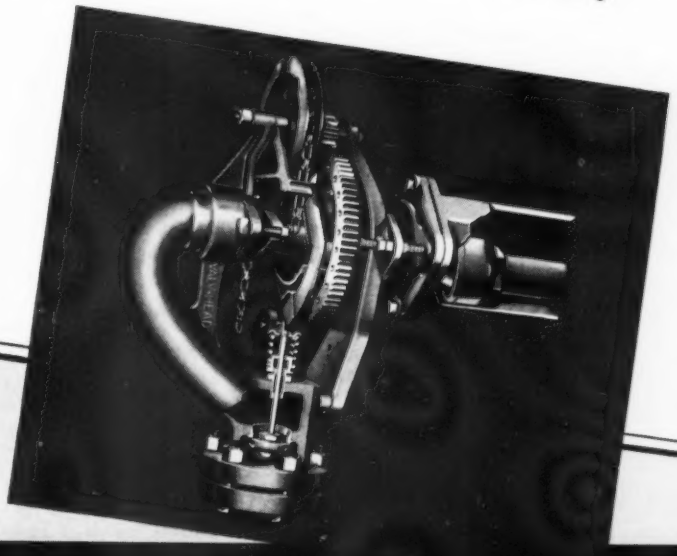
Bearings are important in the maintenance of soot blowers. Clamped bearings must be kept lined up. Serious misalignment may cause warped or broken blower elements. Every time a boiler is taken out of service, bearings should be examined and any misalignment corrected.

Bearings must be kept snug—close contact with the boiler tube cools the bearings. When tightening or renewing bearings, boiler tubes should be absolutely clean where the bearing comes in contact with the tube. After a bearing bolt nut is tightened, the bearing should be hammered lightly to be sure the bearing fits closely to the boiler tube. The nut can then usually be pulled up one or two more turns to insure the bearing being absolutely tight.

When installing new bearings, care should be taken to see that the proper number of bearings are used to support each element. In all cases, the first bearing from the head end is placed on the first tube from the wall, and in general, the bearings are spaced 9″ to 21″ apart for Calorized and Dialoy elements, and from 42″ to 48″ apart for plain pipe elements.

It is important that Calorized and Dialoy elements do not overhang the last bearing more than 11″. Where bearings are installed on every other tube, not more than one nozzle should overhang the last bearing. In the case of plain elements, not more than 24″ of the element should overhang the last bearing.

*Write for this booklet on care of Diamond Soot Blowers.*



THROW YOUR *Scrap* INTO THE FIGHT

*DIAMOND SPECIALTY LIMITED • Windsor, Ontario*

# Swinging Jeeps across the Creeks . . .

## ROEBLING "Blue Center" won't let them down!

It's a fast-flowing stream. A pontoon bridge won't do... So watch the Engineers swing one of their mobile cableways into action. A soldier swims across and a boat follows the line that was lashed to his body. Then comes the Roebling guy lines, bridge cable and anchorage tackle. In no time at all, the motorized winches are hauling jeeps and trucks across the 700 foot span.

It's another of those wartime miracles where the Corps of Engineers wrote the ticket and Roebling supplied the wire-making experience and the wire rope.

Experience from a hundred industries . . . and steel that exactly meets the needs of each. Wire rope . . . right for factory cranes or power shovels or bulldozers . . . right for victory ships or oil well lines or mine hoists. Experience that is woven into every inch of Blue Center, giving it the stamina to withstand unusual loads on the battle or production line.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON, NEW JERSEY
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### WIRE ROPE IS INDISPENSABLE TO WAR

You can do your part to speed output and conserve steel for all America by getting the most out of the wire ropes you have. Faulty sheaves, for example, may be killing your ropes... preventing them from delivering the full service life that has been built into them. Here are a few things to look for:

1 **See that no sheaves are out of alignment.**

2 **Check with a gauge for deeply worn or cut grooves.**

3 **Watch out for broken rims.**

4 **Check for worn or damaged journals that cause sheaves to stick or wobble.**

5 **Check for bent shafts that cause whipping or vibrations.**

To help you inspect wire rope sheaves systematically and easily, we have prepared the helpful pamphlet shown left. Our nearest office will furnish as many copies as you need.

# "You're depending on us..."

# "...and we're depending on you!"

Garlock

We at home are relying on the courage of our fighting men to protect the things we hold dear. But courage alone cannot win battles. Our men are counting on us for a continuous supply of guns, shells, tanks, ships, planes, bombs, food.

Let's not let them down. Let's maintain peak production by avoiding waste, working hard and buying War Bonds!

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*Manufacturers of GARLOCK Packings, Gaskets and KLOZURE Oil Seals*

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12 in. pump delivering 2500 Imp.g.p.m. against 30 ft. head

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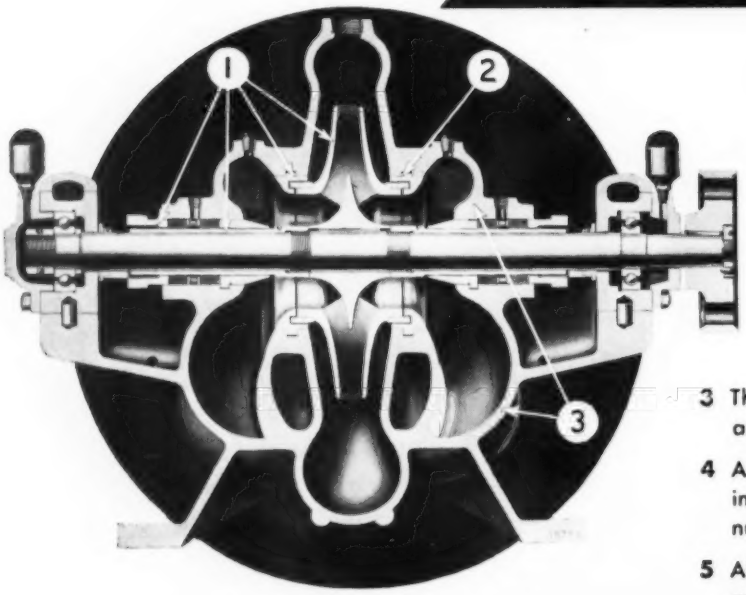


The reliability of De Laval pumps is outstanding and is due to the following features:

1 All parts subject to wear are renewable, including impeller, wearing rings, shaft sleeves and glands.

2 The labyrinth wearing rings, which protect impeller and casing against wear, last much longer than do plain rings, and insure and sustain high efficiency while permitting ample running clearance.

3 The horizontally split casing renders all parts easily accessible.

4 All parts are manufactured to limit gages on an interchangeable system, so that parts ordered by number can be installed by ordinary workmen.

5 Alloys particularly suited to withstand corrosion and erosion are used.

*Write for Publication P – 2537*

HYDRAULIC INSTITUTE USA MEMBER

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TRENTON, N.J.

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VOLUME 87, No. 1

STEAM GENERATION
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PUMPS & COMPRESSORS
PIPING, VALVES & FITTINGS
AIR CONDITIONING, REFRIGERATION
ELECTRICITY AND CONTROLS
INSTRUMENTS AND CONTROL
STEAM SERVICES, HEATING
WATER TREATMENT
TRANSMISSION, LUBRICATION
OPERATION & MAINTENANCE
MISCELLANEOUS

# POWER

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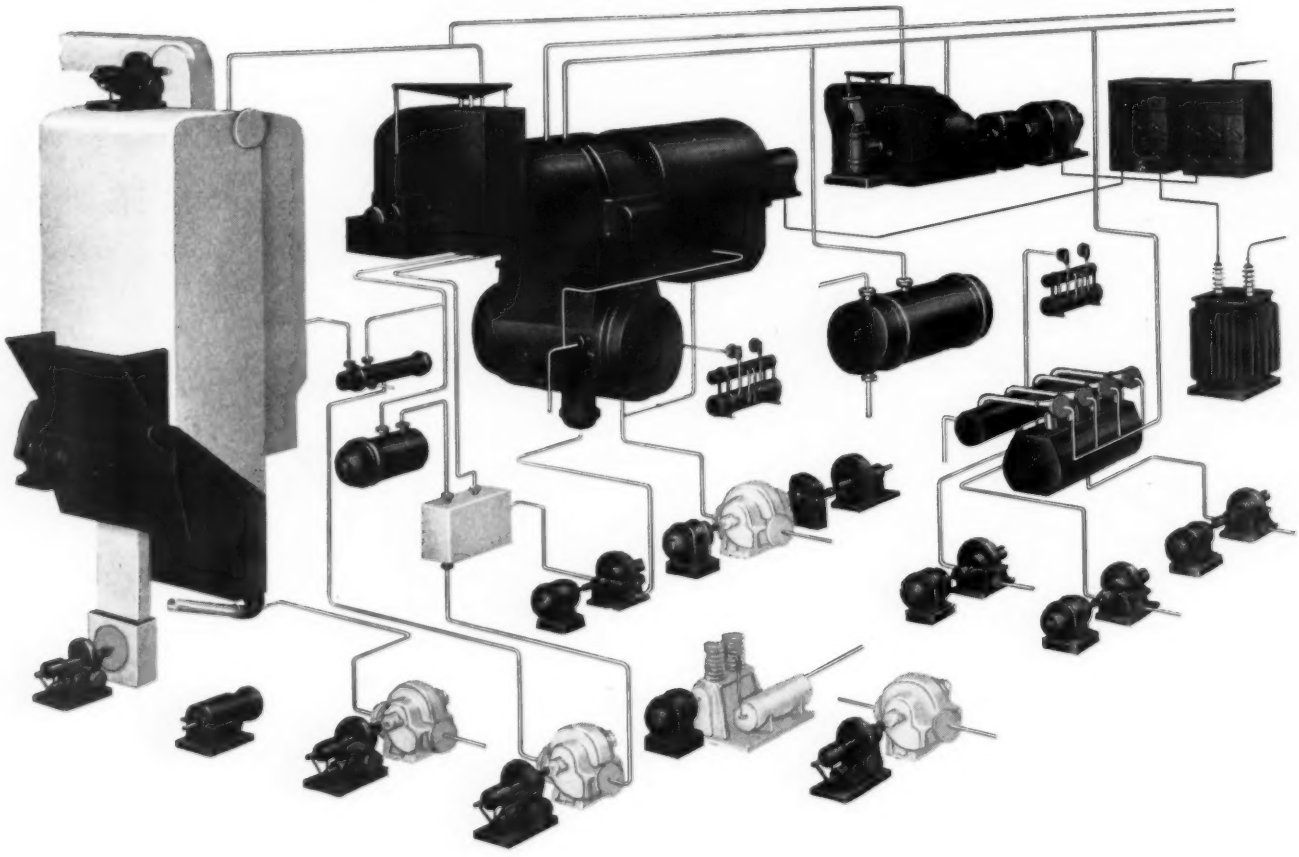
# "Power Plant Auxiliaries?



## for your equipment library...

Copies of any of these publications will be sent to you on request. You'll find them useful, factual—worth-while additions to your library of information on power equipment. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N.

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# see steam headquarters first"

## Westinghouse supplies

# 65% of all power plant equipment

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### 2. engineering

A complete engineering service to help you select and supply the steam equipment for top over-all efficiency and economy in your power plant.

### this unit-responsibility will speed selection and installation of auxiliary equipment

You can avoid the difficulties sometimes involved in co-ordinating power plant operation, making sure each unit contributes its full share towards meeting over-all plant efficiency by placing with Steam Headquarters responsibility for solving your steam auxiliary problems.

A glance at the chart shows that Westinghouse supplies a surprisingly large proportion of all power plant equipment—as much as 65%, to be specific. (Westinghouse equipment illustrated in darker color.) Each one of these varied products incorporates in its basic design the combined thinking of product specialists and steam plant engineers. Modern steam practice demands close co-ordination and a high degree of reliability in auxiliary equipment. To get all the benefits of modern steam practice — it will pay you to see Westinghouse first.

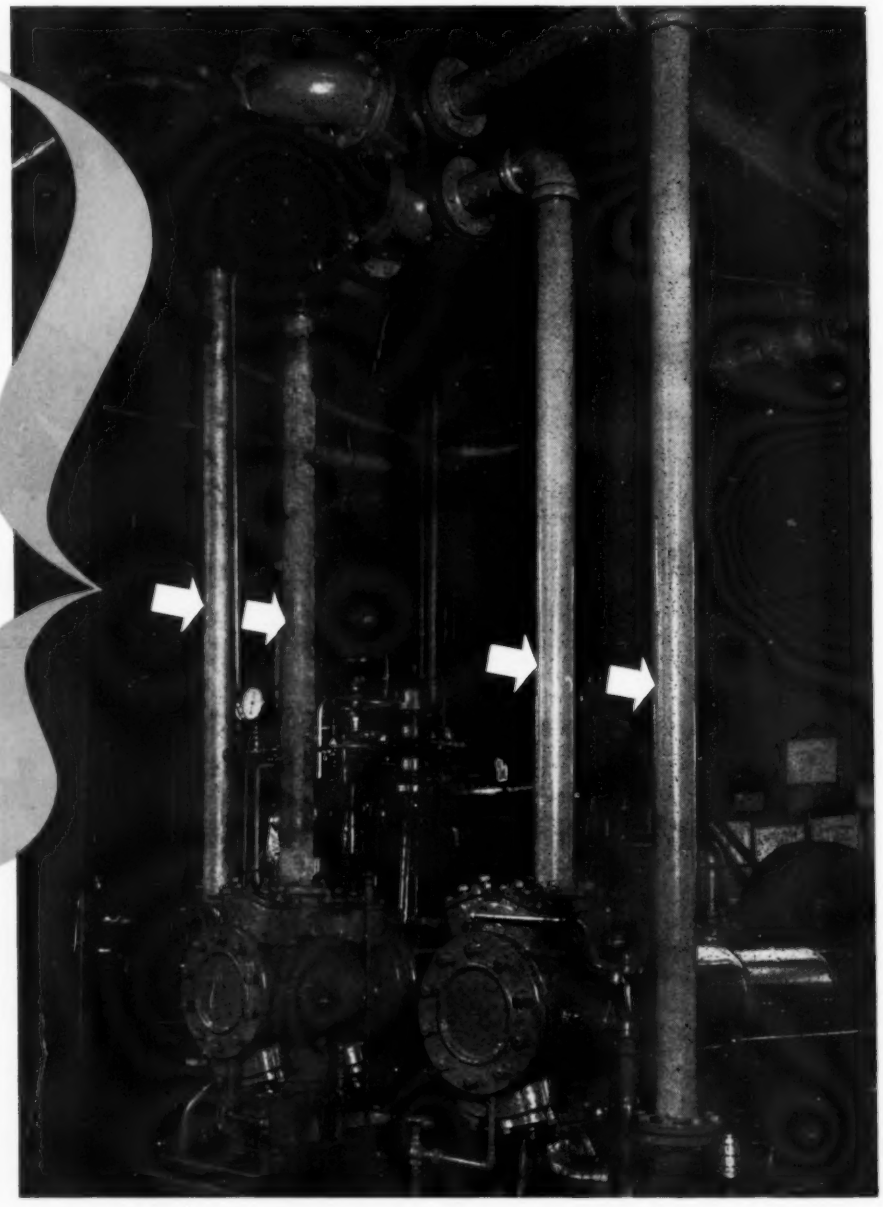
J-50419

Westinghouse

WESTINGHOUSE W

# A brine tank was the "Stock Pile" for this compressor piping job

## BYERS WROUGHT IRON



Doing maintenance jobs right *with the materials at hand* is an important aid in conserving metals needed for war. It is a challenge to the ingenuity of plant engineers, which many old-time wrought iron users are meeting with unusual success.

When piping was needed for two new compressors, the chief engineer of an eastern brewery did not have to tap the precious supply of new materials to get it. From a brine tank no longer in use he reclaimed some wrought iron pipe coils. Although seven years old, the pipe was still in such excellent condition that it was installed without hesitation for the new compressors.

This is only one of many cases where wrought iron has not only demonstrated its use value . . . but its re-use value. In one instance, an engineer used 5500 feet of wrought iron pipe which had served for 38 years without repair in a freezing tank, in constructing a freezer room. He reported that it was not even necessary to rethread the pipe, where full lengths could be utilized!

If you are a user of wrought iron, it will pay you to check any out-of-service piping or equipment, as you may find that what you thought was junk is really a stock pile of completely serviceable material. If you are not a user of wrought iron, it will pay you to investigate its use for any important applications where corrosion or fatigue shortens the life of ordinary materials, and thus avoid repairs that sap the meagre stock of critical metals. We will be glad to send you, from our "Experience Pool", records of the service of wrought iron in applications similar to those in your plant, as a guide in selection. And incidentally, do you have our General Catalog? We will be very glad to mail a copy.

A. M. Byers Company. Established 1864. Offices in Pittsburgh, Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

*Corrosion costs you more than Wrought Iron*

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TUBULAR AND HOT ROLLED PRODUCTS
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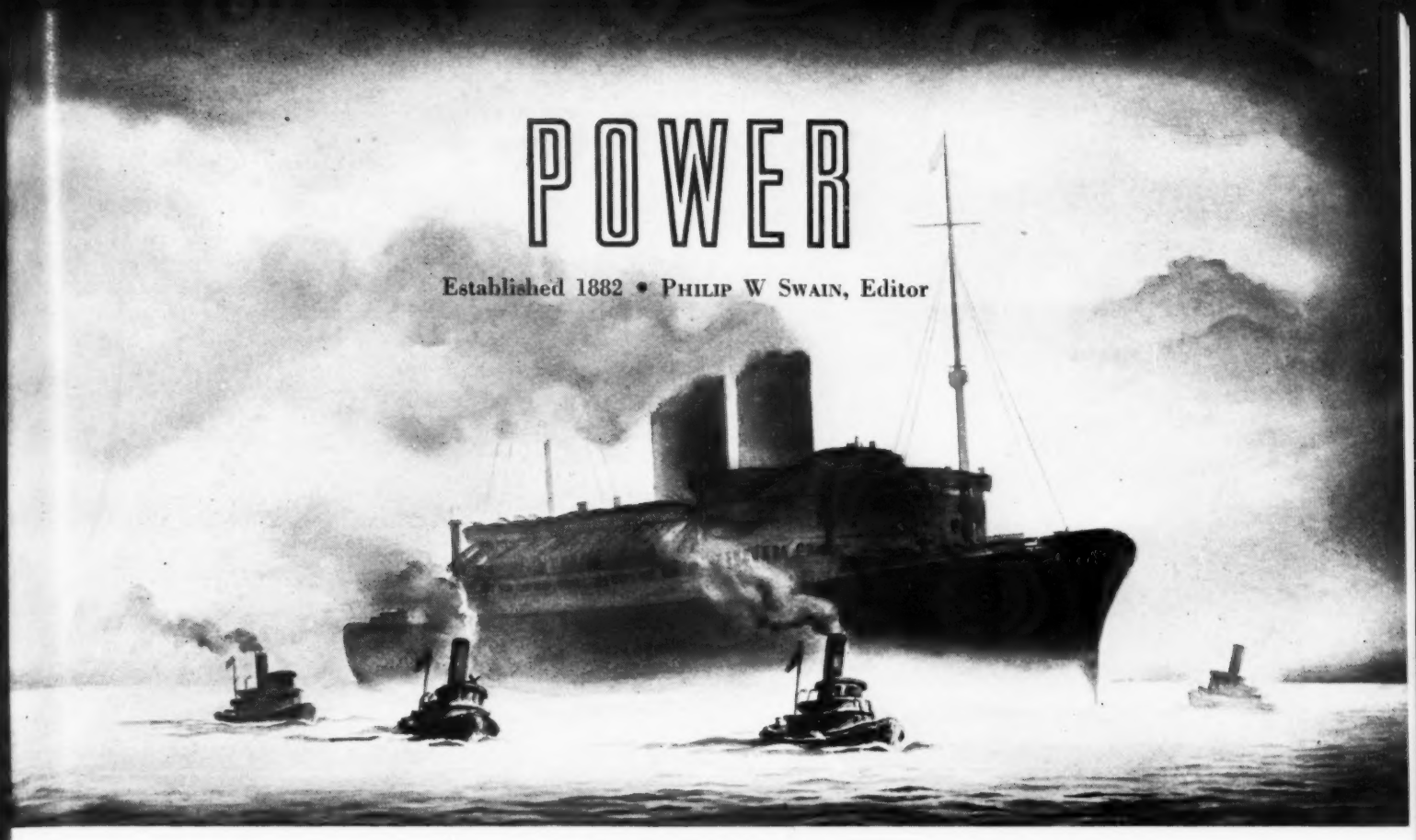



# TRANSPORT

She came up the river in the mist of the morning, in from the embattled seas, from "Somewhere in the Atlantic." For all her dull gray paint and her hidden name, she came proudly in, almost leisuring, no bone in her teeth, no wide-swirling wake. Tugs nuzzled her towering flanks and once or twice she huffed little signal grunts from her deep-throated whistle, but for the most part she came silently, as she goes.

Barge tugs made way for her. Ferries swung wide. The river was hers, and no question about it. Veteran of the swank Atlantic run in peacetime, now she was a war veteran deserving of service stripes and medals. But the only insigne she wore was the small flag at her mast-head. And the deckhands at her rail had no uniforms but work-worn dungarees.

As one ferry crossed her wake, those who crowded the riverboat's foredeck stared up at her steep sides, stared in silence until one man murmured, "What a ship! What a job she's doing!" Instinctively he took off his hat, and a dozen other hats came off in spontaneous tribute, tribute from the heart.

At the aft rail far overhead a man in uniform beneath the transport's deck gun came to a quick salute. And she went up the river toward her berth. A great, gaunt heroine back from another mission.—*The New York Times, Nov 16, 1942.*

✧ Down, down, deep within her, men smile with satisfaction and pride. Once again their queen has deserved her name. Centuries of tradition, years of planning and building supremely fit her for it. But make no mistake about it, those who bring her through, again and again, are *men.* Unhallowed and unsung, they hold an Empire's lifelines in their work-soiled hands. Feeding her boilers, oiling her engines, tending her beating heart, they draw from her forest of gleaming machinery the unfailing power that spells defeat for her enemies. They believe unfalteringly in two things—personal freedom and proper maintenance. They obey blindly, come what may, knowing that a moment's relaxing of their alertness may cost their ship her life. In this knowledge, little individuals become great and powerful units. From lowliest swipe to gold-bedecked chief, these men who love and respect their queen help her to live up to her birthright, to execute with despatch each added mission vital to the "right little, tight little island" where she was born.

# Diesel Ships Circle Globe

S A TUCKER
*Associate Editor*

*Photographs courtesy Westinghouse Electric & Mfg. Co. and Hooven, Owens, Rentschler Division of General Machinery Corp.*

***Maritime Commission C-1B standardized cargo vessels have already proved economy and reliability of electro-coupled oil-engine drive. Marine engineers with diesel experience wanted***

► TWIN-ENGINE GEARED-DIESEL drive for single-screw ships becomes practical only if either engine can be declutched from the reduction gear for maneuvering or maintenance. Electric and hydraulic couplings, in which no mechanical connection between crankshaft and gear pinion exists, not only provide almost instant change in power transmitted to the propeller shaft but also prevent mechanical vibrations of the engine from getting through to the reduction gears.

Diesel cargo ships have already hung up economy records on wartime ocean supply routes that make for longer runs on less fuel. With many diesel-powered vessels in service and more coming off the ways, the Recruitment and Manning Organization of the War Shipping Administration leaves every Port Office latchstring hanging out for "license in force" marine engineers who have diesel operating experience ashore.

Typical of the ships for which engineers are needed are the C-1B cargo vessels illustrated. Driven by a single screw, this flush-deck ship has the raked stem and cruiser stern characteristic of Maritime Commission long-range-program designs. Slightly smaller than Liberty ships, these motorships are driven by a pair of 2-stroke single-acting solid-injection oil engines similar to the unit illustrated in Fig. 1.

Each of the two engine crankshafts drives a pinion of the reduction gear, Fig. 3. Between the engine crankshaft and the gear pinion, an electric or hydraulic coupling is interposed so that there is no mechanical connection that could transmit engine vibration to the gears. Reduction-gear assembly thus requires no greater factor of safety than for steam-turbine drive.

The electric coupling is familiar to many shore operators as a variable-speed drive for fans and pumps. Fundamentally similar to a standard induction motor, except that both stator and rotor revolve, the inner element carries a double set of squirrel-cage bars while the outer element mounts a number of salient field poles excited by direct current through sliprings. When the magnetic field set up by the field poles is cut by motion of the short-circuited squirrel-cage bars, sufficient torque is set up to transmit the rated power.

### *Coupling Construction*

One set of bars creates a high torque at low propeller speed for starting. When engine and pinion speeds are nearly equal, the other set of low-resistance bars does most of the work. Slip amounts to less than 2% at full load.

Hydraulic couplings, also familiar in shore plants as variable-speed drives, consist of two half-doughnut-shaped impeller units faced against each other. When filled with ordinary lubricating oil, one half of the coupling serves as a pump to supply the channels of the mating unit with a continuous flow of oil. The driven half functions as a hydraulic turbine.

Both types of coupling have seen service at sea and have given a good account of themselves. Efficiencies of both are in the upper nineties. Electric couplings require about 11 kw apiece for dc excitation and are self cooled. Hydraulic couplings have a slightly greater slip, need no appreciable auxiliary power and are usually water cooled.

By throwing a switch for the electric coupling, or operating an oil valve for an hydraulic unit, either engine can be clutched or declutched almost instantly. This allows starting the engines and warming them up in port without turning the propeller, or if necessary, overhauling one engine at sea while the ship operates at half power and reduced speed. Maneuvering is accomplished by running one engine ahead and the other astern, power in either direction being delivered to the propeller by manipulating the coupling controls.

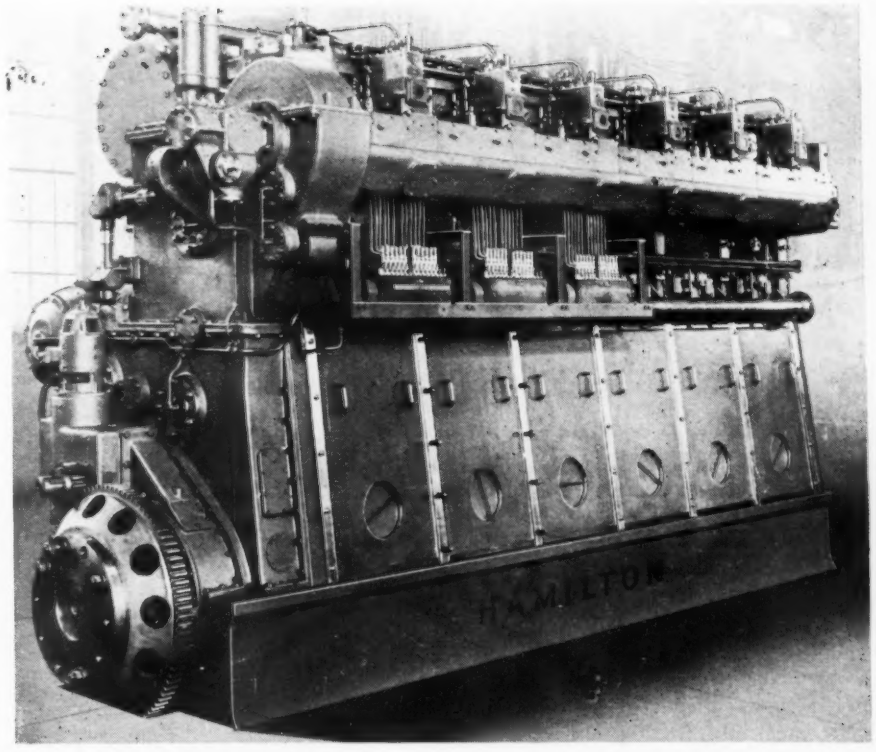



**Fig. 1—Shop view of typical HOR six-cylinder two-stroke single acting solid-injection oil-engine for marine service. Two of these are geared down to power a single shaft**

Auxiliary pumps for fuel, lube and transfer service are motor driven, taking power from two 275-kw 450-rpm 120/240-volt diesel-generating sets which also supply ship power, lighting and communication circuits. These sets are backed up by a 15-kw emergency automatic-starting oil-engine unit. The usual complement of oil heaters and centrifuges resembles those on shore. Machine shop includes lathe, drill press and grinder.

A vertical-tube extended-surface waste-heat boiler supplies 25-psi gage steam for oil heating, radiators in living quarters, hot water heater and salt-water evaporators. These boilers, built for 200-psi maximum pressure are equipped with auxiliary oil burners for use when engines are not operating. If more than required steam is produced while engines are running, excess spills over to a condenser capable of handling the entire output of the waste-heat boiler.

Except for the large size of the electric or hydraulic coupling, few details of ship oil-engine power plants will be unfamiliar to engineers with diesel-plant experience ashore. Where the latter is combined with at least fourteen months at sea in any engine-room job, a man not lacking in courage can avail himself of a one-month training course especially prepared for prospective licensed officers, and enter upon a well-paid career. He will also serve the war effort at his highest skill.

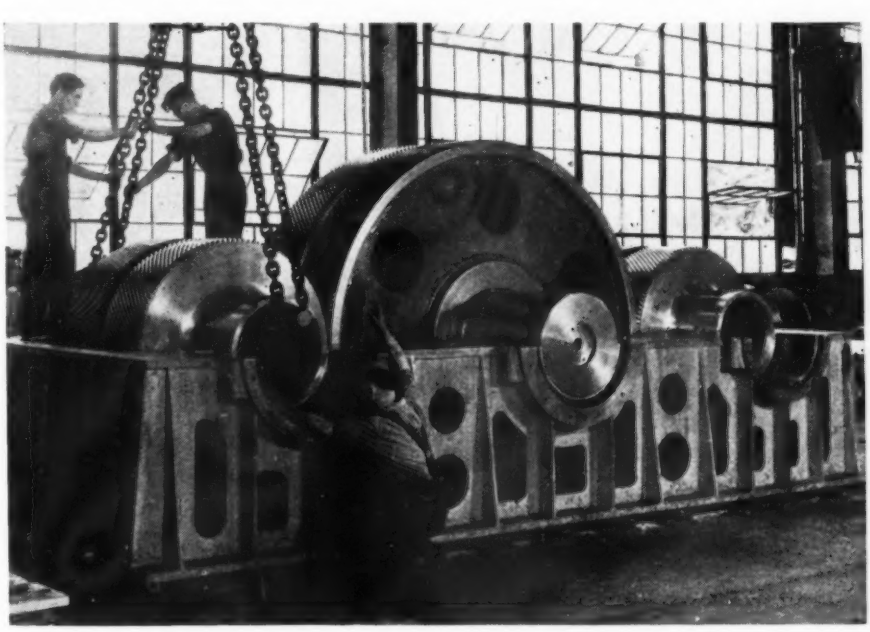


**Fig. 2—Helical pinions and bull gear for typical diesel-marine service**

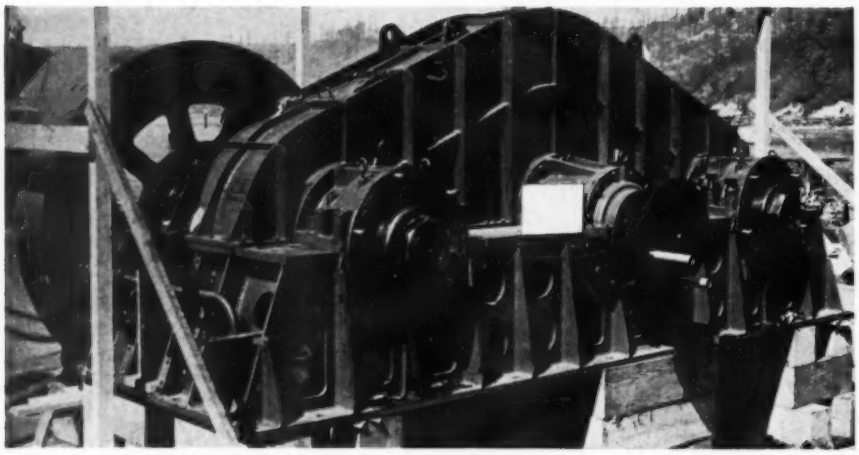


**Fig. 3—Light-weight welded construction reduction-gear case. Note outer member of electric coupling attached to pinion shaft**

Considering that our cargo fleet will acquire more than a thousand ships in 1943 and that some 65,000 seagoing personnel will have to form a labor pool to operate these additional ships, an acute shortage of experienced marine engineers looms almost inevitable. First must come the voluntary enlistment of physically fit (no age limit) men who hold marine engineer licenses.

Many ex-marine engineers, however, hold key positions in utility and industrial power plants ashore where years of service have earned seniority privileges and in some cases, investment in pension plans and the like, that might be forfeited by voluntary resignation to return to sea duty. Such rights are protected for draftees but no provision is enforced for the merchant marine.

Loss of marine engineers from shore positions cannot help but handicap operation of generating plants at a time when war production loads are greatest and experienced operators are taxed to the limit of their skill by lack of new equipment and materials. However, just as for critical materials, there will not be enough experienced manpower to go around and some priority must decide who runs ships and who stays home.

Present recruiting methods are entirely voluntary by registration of qualified men whether or not they hold shore jobs. Return of such men to sea duty has been facilitated in every way, but the functions of Port Office personnel of the War Shipping Administration do not begin unless and until they are requested by the personal appearance or letter of an engineer. A critical shortage of licensed marine engineers is in immediate prospect. Those now registered, not all available, total only one-quarter of estimated need for the first six months of 1943.

Expansion of the training program for younger men as cadets is already producing increasing numbers of newly licensed personnel. However, the basic course requires some 16 months of combined schooling and sea service so that these schools alone cannot keep pace with needs. Another source of officer material is available from upgrading of present engine-room personnel after approximately one month of special schooling. Any man with at least 14 months of sea experience can apply for this training.

Recent graduates and students having completed three years of mechanical engineering at a recognized college or university are being encouraged to ship as junior third-assistant engineers, unlicensed, after only a month or two of special training.

These several training programs, supplemented by the present known backlog of experienced marine engineers, cannot be expected to furnish enough engine-room officer personnel. More engineers must go to sea. They must know both sea lore and ship machinery for their own safety as well as for that of the rest of the crew and the cargo. Detailed procedure has not yet been worked out, but as the need grows greater more drastic measures will be necessary. Marine engineers now in shore jobs should warn employers of the critical situation.

**Fig. 4—All welded spider construction of outer-coupling carries direct-current field poles supplied through slip rings on the pinion shaft (not shown) attached to rear face of coupling**

**Fig. 5—Inner element of electric coupling is mounted on the engine crankshaft. Double-deck squirrel-cage winding provides high torque at both low and high speeds**

# Experience Shows 116-ft Deep Coal Pile Practical

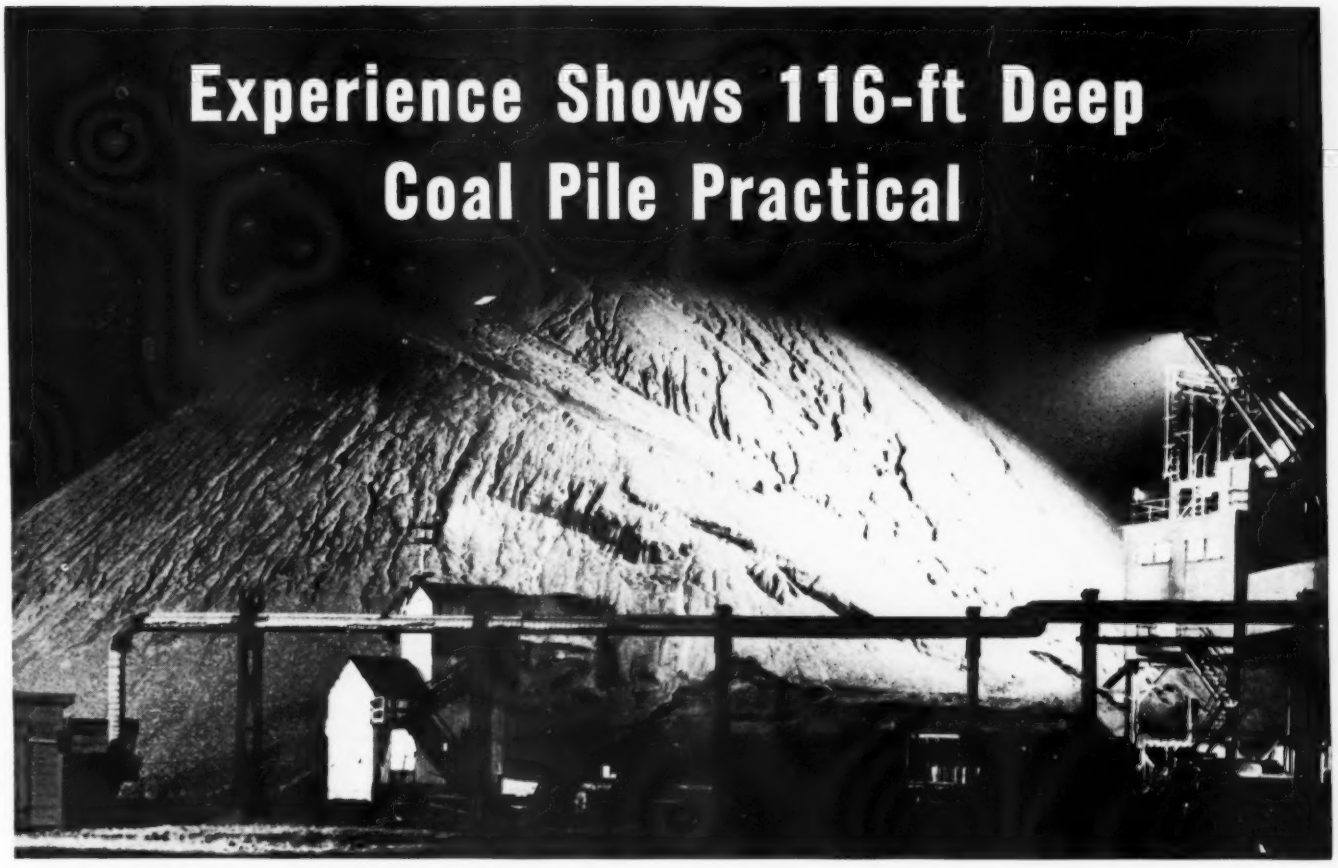


**Fig. 1—This photo taken at 11:00 p.m. shows the coal pile when it was 110 ft high and contained 150,248 tons. Good illumination permits around-the-clock operation. The small gulleys on the side of the pile are erosions caused by heavy rain**

***Large industrial plant increases coal-pile depth from 48 to 116 feet, and boosts pile capacity from 39,254 to 150,248 tons in limited space. Plant superintendent tells of relieving moisture, fire and weather difficulties which arose during operating period***

► MANY POWER-PLANT ENGINEERS have never stored coal before out doors or, if they did, stored comparatively small quantities. Today, to assist in the war effort by helping to make the best use of our transportation facilities and to insure operation of their plants, these engineers are storing large quantities of coal under a wide variety of conditions. In this work, many problems arise. To assist in their solution the steam-plant superintendent of a large industrial plant in Canada gives his experiences with what is probably the highest coal pile in the world.

As shown in Fig. 2, our coal comes to us by rail, the cars being dumped into a hopper at *A*, emptied by a skip hoist *B* into a chute leading to a dragline storage or to a ring crusher. Crushed coal moves to a belt conveyor *C* for delivery to the overhead bunker in the boiler room. Original coal-storage equipment included a 140-ton-per hr double-bucket balanced skip hoist; a double-drum drag-scraper winch, with a 4-ton scraper driven by a 125-hp motor at a cable speed of 375 fpm; and one movable backpost car. In the summer of 1940 we wanted to increase our coal-storage capacity so had the manufacturers of the original storage equipment install three 80-ft backhaul towers. The diagram, Fig. 3, shows the present coal-storage and handling arrangement at our plant.

### *Coal Pile Increases*

Our original coal-piling ground area amounted only about 40% of its present size. When the backhaul towers were installed in 1940 the backhaul car tracks were moved back 30 ft, increasing the area for coal storage to 121,000 sq ft. In 1936 we stored 39,244 tons of coal and piled it 48 ft high and in 1939 we stored 55,551 tons and piled it 65 ft high. During this period we used the movable haul car at ground level to pile the coal and found that when the pile reached 65-ft high the drag winch motor was overloaded, and the limit of the equipment reached. This led to the installation of new backhaul towers and other changes previously mentioned, because we wanted to store more coal for probable increased steam demands.

With the new towers installed we stored 148,746 tons in 1940 in a pile 110 ft high. In 1941 we stored only 111,731 tons, but in 1942 to date we have stored 150,248 tons in a pile 116 ft high. When this year's storage is completed we expect the pile to reach 125 ft high and contain 165,000 tons with the bottom of the pile spread to the backhaul track.

When we pile coal we connect the cable to the backhaul car, start at the north side of the storage ground and build a layer about 40 ft high, dragging the coal into the pile from east to west, extending it from north to south. Spreading is done by moving the backhaul car on its tracks from north to

south. After completing this layer of coal, we change the cables to backhaul sheaves connected to the towers and build up the pile to about 90 ft starting from the north and spreading to the south. We then change the drag scraper from the 4-ton scraper to the 2-ton and finish the pile to the maximum height, spreading from north to south.

Fig. 1 and 2 show the drag-winch control house on the southeast side of the coal-storage ground. We have to work from north to south when piling and spreading and from south to north when taking coal out of the pile, so that the coal-drag operator can see what he is doing. The coal-storage ground is illuminated, Fig. 1, so that we can operate 24 hr per day.

### *Experience With Water*

In the spring of 1935 we had about 25,000 tons of coal in storage. This coal was stored in the pile in 1932, when it rose about 30 ft high. During the winter of 1935 and 1936 we experienced difficulty with wet coal. Moisture ran from 10 to 22% and caused serious trouble in the pulverizers. We concluded that the high moisture content developed while the coal was in storage because the pile was low and spread out with a large surface exposed to the weather.

We now find that by storing the coal 110 ft high the pile takes a natural shape with a small exposed area, forms a good roof and makes the water run down the side of the pile. In Fig. 1 the small gulleys were caused by heavy rain that fell the evening before the photograph was taken. On the south side of the pile, Fig. 2, the water ran down the outside of the pile to within about 30 ft of the bottom. It then followed in through the coarse coal and ran out at the edge of the pile, as can be seen in the lower lefthand corner, *S*. On the east side the water runs into the coal pit and we have to start the syphons.

When we take coal from the pile we start at the south side and run the cables through the backhaul tower sheave and start the drag scraper about 40 ft up on the south side of the pile. We work the scraper with snatch blocks until we have a flat shelf about 20 ft from the ground. We then change the cables to the backhaul car and drag the coal down to within 3 ft of the

## Proximate Analysis of Some of the Coals Stored

| | Dominion | Valley Camp | Reynolds-Minto | Reynolds-ville | Kramer | Federal |
|---|---|---|---|---|---|---|
| Volatile, % | 32.73 | 29.1 | 31.5 | 33.5 | | 36.7 |
| Fixed Carbon, % | 56.90 | 64.3 | 54.2 | 57.4 | | 54.8 |
| Ash, % | 10.37 | 6.6 | 15.8 | 9.1 | | 8.9 |
| Sulphur, % | 3.09 | 1.7 | 6.18 | 3.14 | | 2.87 |
| Btu, per lb | 13,310 | 14,560 | 12,920 | 13,950 | | 13,780 |

**Fig. 2—Dark streaks on the left side of the pile show how the water ran down during rain storm to within 30 ft of the bottom of the pile, it then followed down through the coarse coal and ran out along the ground at the bottom in a stream at *S***

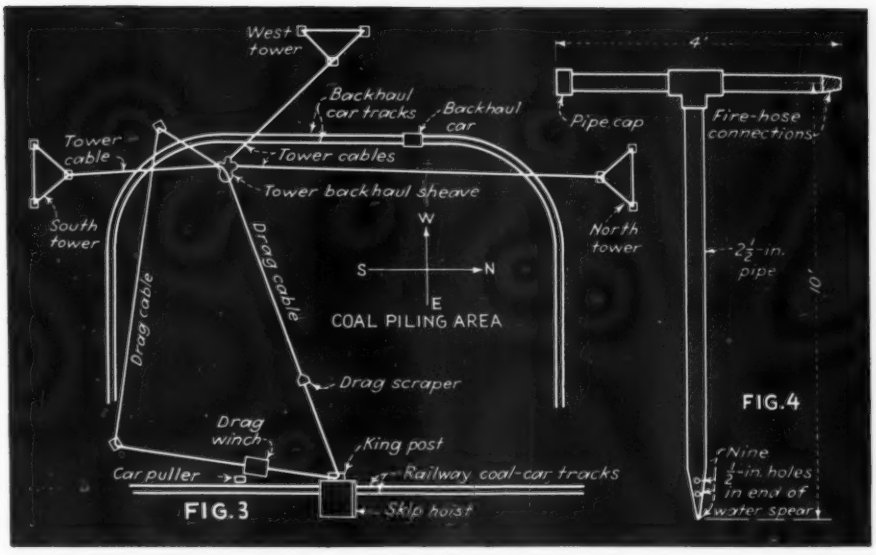



**Fig. 3—Layout of coal-piling ground and the coal-handling equipment. Fig. 4—Design of water spear used to extinguish fires in the coal pile**

ground. From this point we drag across the pile, forcing the scraper to bite into the south side of the pile, and leaving this side nearly perpendicular.

Snow or ice will not rest on this face when the north side may be covered with it; therefore, during the winter we get "dry" coal from the pile, the moisture running from 3 to 6%. Any snow that collects during a storm is dragged out to the west side of the pile with the scraper. We have no trouble with frozen crust on the top of the pile as we can always drag in under the coal at the bottom until it will not support itself and falls off. No danger confronts the men because they are not near the scraper.

If a large amount of coal falls from the working face of the pile and buries the scraper so that the winch cannot pull it out, we hook on another drag scraper and let it dig the buried one out while taking coal from the pile.

### *Bituminous Coal Stored*

We have stored only bituminous coal at our plant. From 1932 to 1936 we kept temperature pipes in the coal pile, twelve in all. We drove these pipes in from the top of the pile to within 10 ft of the bottom. A maximum-registering thermometer was installed in each pipe and read once a week. In the southwest corner of the pile about 100 ft in from the edge the temperature went up to 180 F in six months. After that it took about a year to drop to 90 F. All other parts of the pile showed about 90 F from the time that the coal was stored until it was used.

When the coal under the temperature pipes that showed 180 F was dragged out we found a large block of coke starting about 2 ft from the ground. The block was 6 ft high, 20 ft wide and 60 ft long. The coke tested 11,200 Btu per lb. This coal was all Valley-Camp slack and Freeport slack with a heating value of 14,300 to 14,560 Btu per lb. During the time that this coal was in storage there were no fringe fires or smoke noted.

From 1936 to date we have stored in the same pile, Freeport slack, Valley-Camp slack, Federal slack, Christopher slack, Rachel slack, Emily slack, Lincoln slack, Roaring-Run slack, Reynoldsville-Kramer slack, Sydney slack, Dominion slack and Minto slack. Most of the coal in the pile today is Christopher and Federal slack. The table shows an analysis of some of these coals. Some of them it will be noted, have a high sulphur content.

When the coal was stored in 1940 we were troubled with fringe fires. To put them out we used a water spear like that in Fig. 4. On the north side of the pile about 75 ft from the ground a fire broke out which was hard to get at. We kept spears there for six months and treated the area with water every week. Finally we put it out, as we have not seen any signs of it for a year. The coal on the north side of the pile has been in storage since the summer of 1940 and after about a year in storage there is a marked decrease in fringe fires. After a heavy wind we may have one or two.

### *Fringe Fires in Coal Pile*

We have not put temperature pipes in the pile since we piled the coal 110 ft high because to drive pipes into the pile would be like driving a well and would require a lot of pipe. If we find a hot spot there is no place to move the coal. We are of the opinion that the coal in the center of the pile has not overheated because by the spring of 1941 we had used 60% of that in storage. This took us more than half way across the pile, and we noted that all the coal was well packed and in good condition. The coal that we have stored in the last few months, to replace that taken out of the pile, breaks out in fringe fires, but they are mostly on the southwest corner of the pile.

When coal-burning boilers generate all steam we will burn 125,000 tons of coal per year. This is one of the reasons for having such a large storage pile; the other is lower moisture content. The fuel losses caused by coal overheating in the storage pile from 1940 to date will amount to not over 100 tons, a negligible quantity.

✦ ✦ ✦

## Cement Wash Prevents Corrosion

Life expectancy of large condensate receivers and surge tanks may be seriously lowered unless steps are taken to control corrosion and pitting of their internal surfaces. Chemical treatment of condensate for the removal of oxygen and other corrosive agents is seldom feasible so far as this class of equipment is concerned and it is usually necessary in the interest of economy and practicality to use some mechanical means of inhibiting corrosion.

Where the internal surfaces of the receiver are accessible a cement wash is one of the best inhibitors of corrosion. Before applying this wash, surfaces should be thoroughly clean of oil and grease, all scale and rust removed by wire brushing or sandblasting, and then thoroughly dried. In making the wash ordinary portland cement may be used. There are, however, a number of special hydraulic cements intended for the purpose available commercially that are more satisfactory.

A solution of cement and water is mixed to the consistency of heavy cream and applied to the surfaces with a brush. The coating must be completely dry before filling the receiver or tank with water. The effective lifetime of the coating will vary with local conditions but ordinarily if applied to thoroughly cleaned surfaces it should protect the receiver or tank against corrosion over a period of three to five years.

# How Vacuum Affects Turbine Capacity

***G L Graiff outlines the ABC's of the relation between condenser vacuum and turbine performance for the benefit of junior operators and old-timers who want to brush up***

▶ MOST OPERATORS KNOW that increasing turbine vacuum boosts capacity and many know fairly closely what the gain amounts to and why. For the benefit of those who have not had occasion to investigate the matter and for the younger operator, here is a brief statement of the basic facts and some data on the relation between turbine capacity and vacuum in an actual plant.

How vacuum affects turbine output can be seen clearly on a Mollier chart (see "How to Use the Mollier Chart," POWER, June, 1942, pg 117). Steam expanding through a turbine does so, theoretically, with no gain or loss of heat to or from the confining surfaces. Such a theoretical turbine is often called a *perfect* turbine and the process of expansion without gain or loss of heat is called *adiabatic* expansion. Without defining that troublesome term entropy we can simply say that such an expansion occurs without change in entropy. The calculations that follow are based on a "perfect" turbine with adiabatic expansion.

### *Turbine Calculations*

Consider steam, at an initial pressure of 225 psi gage, expanding through a turbine to a condenser operating at 29 in. Hg vacuum. The Mollier chart indicates pressure in absolute terms so this would be the same as saying 240 psi abs and 1 in. Hg backpressure. The Mollier chart shows that at 240 psi abs the heat content of one lb of steam (called *enthalpy*) is 1200.6 Btu per lb. Because we assume that the steam expands adiabatically or at constant entropy, we can follow down the vertical *constant-entropy* line from 240 psi abs to 1 in. Hg. At this point the heat content amounts to 821.5 Btu per lb. The difference in the heat content from initial to final conditions represents the heat energy converted to mechanical energy, or since the turbine drives a generator, into electrical energy. The difference in the heat contents is 1200.6 minus 821.5 or 379.1 Btu per lb. Remembering that 3412 Btu equals one kwhr, we find that the electrical energy developed is 379.1 divided by 3412, or 0.11 kwhr per lb of steam.

In the same manner we can find the energy developed by expansion from 240 psi abs to various final pressures, Table I. From the tabulated data it can be seen that by increasing the vacuum to 29 in., we make the following gains:

From 26 to 29 in. = 17.5% gain
From 27 to 29 in. = 13.5% gain
From 28 to 29 in. = 8.5% gain

From this it is easy to see that when dirty condensers and warm cooling water cut condenser vacuum to 26 in. the loss is substantial.

While dealing with the matter of vacuum, we should straighten out a popular misconception that causes much confusion. Weather conditions, as shown by changes in barometric pressure, exert no effect on the actual operation of turbines. Opinion has it that low barometric pressure during stormy periods means low condenser vacuum, and consequently lower capacity. When viewed correctly, in terms of absolute pressure, this is not the case.

In a mercurial barometer, one leg is sealed at its upper end and completely filled with mercury. The other end is open to the atmosphere. Because no pressure is exerted on the mercury column in the sealed leg, atmospheric pressure on the other leg forces the mercury up in the sealed leg until the weight difference in the mercury columns equals the pressure exerted by the atmosphere. This difference, in inches of mercury, is the absolute atmospheric pressure, and will vary according to weather conditions.

Now consider an open mercury manometer connected to the condenser. The absolute pressure of the atmosphere, being greater than the absolute pressure in the condenser, forces the mercury down in the open leg until the difference in weight of the mercury columns balances the difference in absolute pressure. The manometer has measured the *difference* in pressure between the atmosphere and the condenser. To find the condenser pressure, we have to subtract the manometer reading from the barometer reading, the actual atmospheric pressure.

It can now be seen that since atmospheric pressure acts on both the barometer and the manometer, any variation caused by weather conditions will exert the same effect on each. Thus absolute pressure in the condenser is not affected by weather conditions and changes in barometric pressure.

Condenser vacuums are usually spoken of as being "referred to a 30-in. barometer." This simply means that

**Table I—Theoretical Gain from Increased Vacuum**

| Final Pressure | Heat Content, Btu/lb | Difference in Heat Content, Btu/lb | Energy, kwhr | Percent of Energy at 29 in. |
|---|---|---|---|---|
| 25 psi abs | 1031.5 | 169.1 | 0.0495 | 44.7 |
| 14.7 psi abs | 980.0 | 220.6 | 0.0646 | 58.3 |
| 4 in. Hg abs | 887.8 | 312.8 | 0.0915 | 82.5 |
| 3 in. Hg abs | 873.0 | 327.6 | 0.0959 | 86.5 |
| 2 in. Hg abs | 854.2 | 346.4 | 0.1015 | 91.5 |
| 1 in. Hg abs | 821.5 | 378.1 | 0.1110 | 100.0 |

the vacuum is given as if the barometer had actually read 30 in. of mercury at the time the reading was taken, 30 in. being considered as normal atmospheric pressure. Assume that a mercury manometer read 27.5 in. Hg at the same time the barometer read 29.5 in. This represents a condenser pressure of 2 in. Hg (29.5 — 27.5). Referred to a 30-in. barometer, the condenser vacuum would be 30 — 2 = 28 in. Hg.

To get back to the effect of vacuum on turbine performance, and particularly to an actual case, four units in one plant showed these absolute pressures or vacuums on a certain day:

| Unit | Load, kw | Abs Press, in. Hg. | Vacuum, in. Hg |
|---|---|---|---|
| No. 1 | 550 | 4.5 | 25.5 |
| No. 2 | 1100 | 2.75 | 27.25 |
| No. 3 | 850 | 2.75 | 27.25 |
| No. 4 | 1900 | 3.0 | 27.0 |

The gain in kw output (without taking any more steam from the boilers) resulting from bringing all units up to 29 in. vacuum would be as follows:

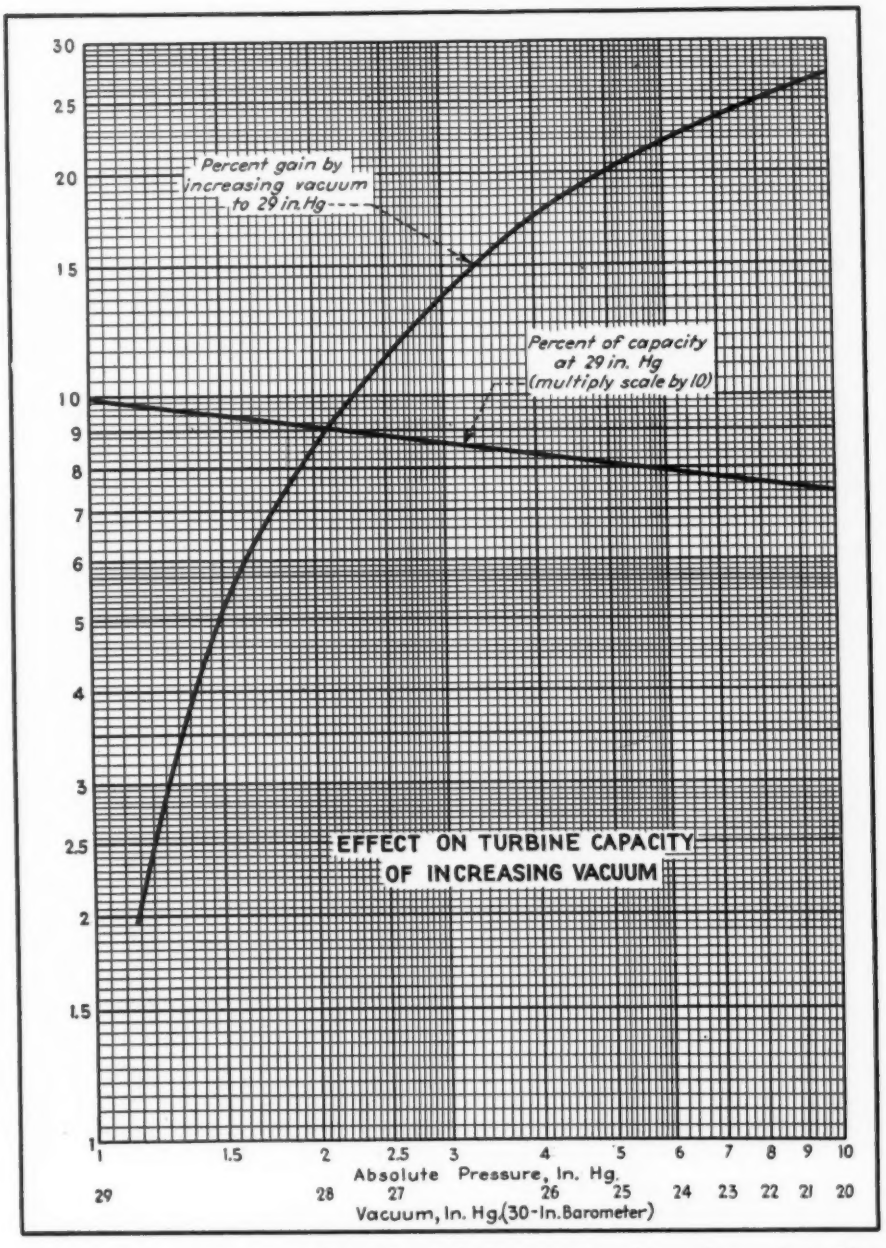
| Unit | Load, kw | Increase, % | Increase, kw |
|---|---|---|---|
| No. 1 | 550 | 19.75 | 103 |
| No. 2 | 1100 | 12.25 | 156 |
| No. 3 | 850 | 12.25 | 106 |
| No. 4 | 1900 | 13.50 | 256 |

These figures represent theoretical gains, based on the chart (right), which is drawn for a perfect turbine. The indicated total increase of 621 kw (about 14%) would, of course, run somewhat less for the actual turbines, but serves to demonstrate the importance of maintaining high vacuum conditions in the condenser.

Maintaining high condenser vacuum involves attention to several factors. First, and foremost, condensers must be kept clean. Amount of work required to keep surfaces clean varies from plant to plant, depending on water conditions. In the plant discussed above, keeping high vacuum meant blowing out the units every two weeks, at least, and washing once a week. Water screens, and pump-suction foot valves and screens, need similar frequent attention.

### *Short-Circuiting*

One difficulty experienced at this plant illustrates a problem found in many others. Warm water from the condensers discharges into the bay only a short distance from the pump-well inlet. On incoming tides, this makes little or no difference. On outgoing tides, the warm discharge water flows toward the inlet bay and noticeably warmer water enters the pump suctions and flows through the condensers. This represents an item of real importance as cold water is absolutely essential to maintaining high vacuum. Some plants cure this trouble by building weirs or other arrangements to separate inlet and outlet water streams effectively.


Percent gain by increasing vacuum to 29 in. Hg
Percent of capacity at 29 in. Hg (multiply scale by 10)
EFFECT ON TURBINE CAPACITY OF INCREASING VACUUM
Absolute Pressure, In. Hg.
Vacuum, In. Hg. (30-In. Barometer)

**This chart, for a *perfect* turbine with adiabatic expansion, shows changes in turbine capacity resulting from increasing or decreasing condenser vacuum**

Air leaks in the vacuum circuit must be held to an absolute minimum for high-vacuum performance. This applies not only to leaks at joints, but to glands, pump packings and corrosion pitting as well.

All the air pumps, both steam jet and mechanical, should be gone over thoroughly at regular intervals to check for wear on each part. Equipment of this kind should not be run "until trouble develops." In most cases, trouble can be avoided or anticipated by a conscientious checkup program. This means more than just looking things over—equipment should be dismantled completely so that each part can be subjected to close physical examination. A program based on checking one item of the circuit at a time will not interfere with operation.

The same line of reasoning applies to the other items of the vacuum circuit. The atmospheric-relief valves, for instance, should be dismantled sufficiently to permit thorough inspection of condition of all parts. All in all, good maintenance pays dividends in continued high-vacuum performance and thus permits more efficient utilization of steam supplied to the turbines.

# Good Exhaust Practice Improves Diesel Performance

***The exhaust system isn't just a few pipes to carry gas away—it has a direct effect on engine operation. Glenn Boyer, Burns & McDonnell Engrg Co, shows why exhaust arrangements are important and gives practical pointers for improving the hookup***

▶ A DIESEL-ENGINE EXHAUST system has three basic jobs to do: (1) it must carry exhaust gas to a point where its rejection will not be objectionable, (2) it must release the exhaust with a minimum of noise, and (3) it must place as little backpressure on the engine as possible. Too many exhaust systems were designed with *only* the first job in mind. Failure to do all three jobs properly means that the plant will not perform in the quiet, efficient manner expected.

Engine-exhaust behavior has been the subject of many experimental investigations in recent years. These show that pressures as great as 7 psi build up in the exhaust pipe within 0.003 seconds after the engine exhaust opens, Fig. 1. Such pressure rises result in rapid acceleration as the gas moves out the exhaust line, and the gas velocities attained are high. The pressure drop following is practically as rapid as the initial rise.

As pointed out by one investigator[1], "The gas in an engine cylinder is still under considerable pressure and temperature at the bottom of the piston's power stroke. Immediately following the opening of the exhaust valve or port, this gas is forcibly ejected down a pipe like a compressed spring suddenly released. Like the spring, the gas possesses mass and elasticity and when released and the valve is again closed, it overruns, that is stretches itself out well beyond its normal length. This, coupled with the cooling of the gas and the condensing of the vapors, results in a partial vacuum following the 'slug'. With the slug out of the way, air is sucked into the pipe and there is set up in the exhaust conduit a severe oscillating condition. Pressure waves of considerable amplitude are reflected back and forth in the pipeline at acoustic velocities. The frequency of the reflected wave depends primarily on pipe length and somewhat on pipe diameter and gas temperature. In any event, this condition is detrimental since it results in noise and, quite often, impaired engine performance. For this reason, it is necessary to process the exhaust waste before it is released to atmosphere to prevent entirely destructive reverberation."

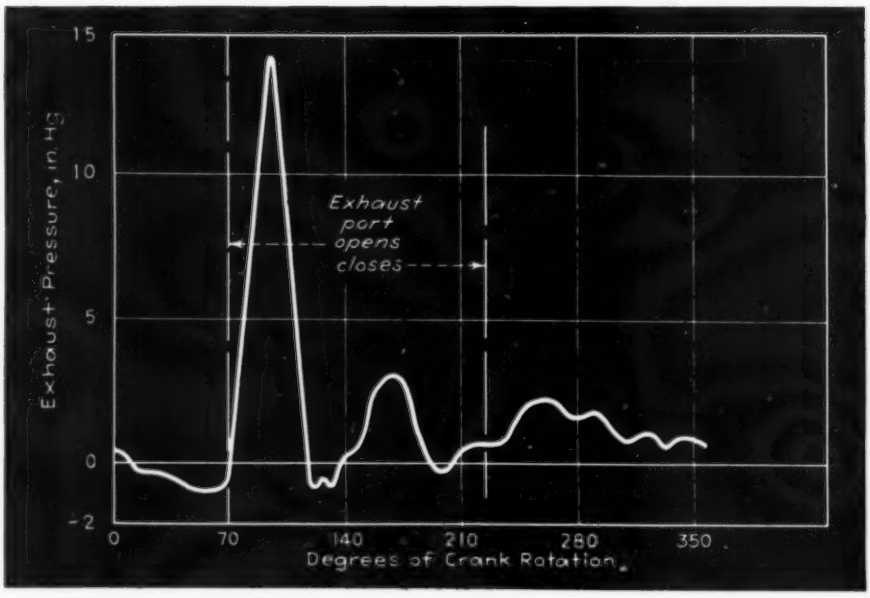



**Fig. 1—Variations in exhaust pressure of 2-cycle single-cylinder blower-scavenged diesel engine, operating at 1200 rpm, plotted against crank angle**

### *Exhaust Length*

Fig. 2 shows clearly how the length of the exhaust line definitely affects the characteristics of the pressure oscillations resulting from expulsion of a gas slug without muffling. It is well known that when a muffler is not used the length of the exhaust pipe can be proportioned to have either a beneficial or harmful effect on exhaust-gas scavenging. Fig. 2 shows that only a slight change in exhaust-pipe length creates a cylinder pressure at the time of exhaust valve closing that is either above or below atmospheric. Either condition might be harmful. For example, an excessively high cylinder pressure may reduce the quantity of oxygen in the cylinder sufficiently to interfere with proper fuel combustion.

Oscillating characteristics of the exhaust exert a marked effect on fuel consumption, exhaust backpressure and exhaust temperature, as shown in Fig. 3. In this series of tests, the effect of different exhaust-pipe lengths was studied on an engine running at constant load; for each length of exhaust pipe the engine was tested with and without a snubber. It can be seen that without snubber equipment, the exhaust-pipe length markedly affects fuel rate, backpressure and exhaust temperature and that for a particular engine there seem to be one or more exhaust-pipe lengths that give best results. On the other hand, when the engine is equipped with a snubber, exhaust length exerts little influence.

[1] Alfred S Chipley, *Diesel Engine Exhaust Silencing*, Engrg Bul 117, Burgess Battery Co, Chicago, 1941.

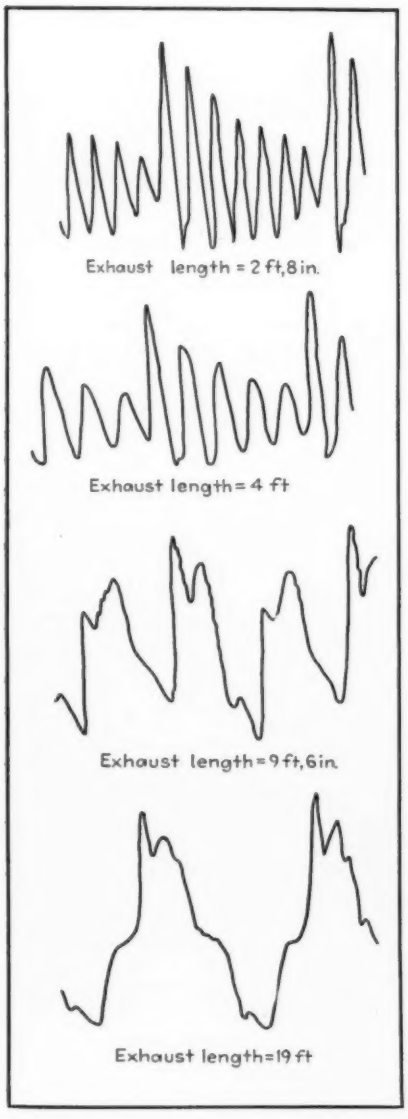



**Fig. 2—Effect of exhaust-pipe length on character of exhaust pulsations**

From the foregoing, it can be seen that providing a satisfactory exhaust system is necessary but not easy. The problems involved are not subject to mathematical analysis. While the progress that has been made in developing muffling equipment has been exceptional, most of it has come about through endless experimentation. This has evolved several excellent exhaust mufflers or snubbers and the plant designer can select that silencing equipment which best suits the conditions confronting him.

Most mufflers are now fabricated of welded steel plate although some are made of cast iron. The several available types include units with spark-arresting chambers for hazardous locations and a combination muffler and waste-heat boiler. Muffler size depends on cylinder dimensions and engine type; correct size for a given engine can be obtained from either the engine or muffler manufacturer.

"The size and arrangement of exhaust piping from a diesel engine should be such that it will not cause undesirably high backpressures in the engine cylinders.[2] High backpressures reduce the capacity and efficiency of the engine, and, indirectly, increase lubrication difficulties and maintenance expense, by inducing high cylinder temperatures.

### *Backpressure*

"The total backpressure should not exceed 15 in. $H_2O$ at the outlet of the engine exhaust header, and will be built up of the friction in the exhaust pipe and the resistance in the exhaust silencer and spark arrester. The former should not exceed 3 in. $H_2O$; the latter combined, should not exceed 12 in. $H_2O$.

"Exhaust piping should be short and straight as possible. Bends should be of long radius. Abrupt changes in diameter should be avoided. In determining the pipe size, allowance must be made for fouling of the piping. To avoid long and involved calculations, the appended curves, Fig. 4, have been prepared as applying to an average arrangement of piping to impose a backpressure of about 3 in. $H_2O$ in the piping alone. These curves represent good modern practice when the piping is not unusually long or crooked, or conversely, unusually short and straight."

Exhaust systems are usually fabricated with standard-weight welded-steel pipe. If spiral-welded pipe is used, the pulsating exhaust gas sets up drumming noises in the pipe. The exhaust line should have welded joints and should include provision for expansion, which may take the form of

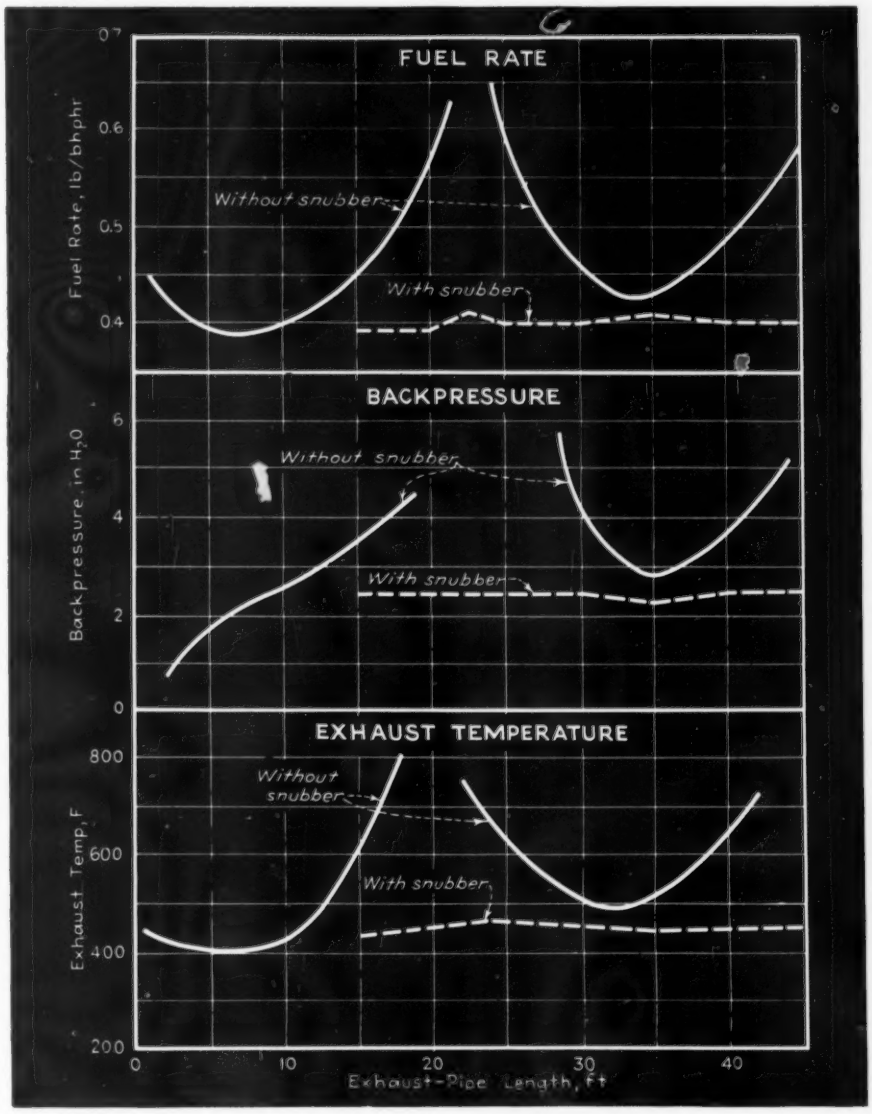



**Fig. 3—Effect of exhaust-pipe length on fuel consumption, exhaust pressure, and exhaust temperature, for an engine with and without snubber equipment**

[2] The material quoted here was prepared especially for the author by Max Rotter, who, prior to his death in 1940, was consulting engineer for Busch-Sulzer Bros Diesel Engine Co.

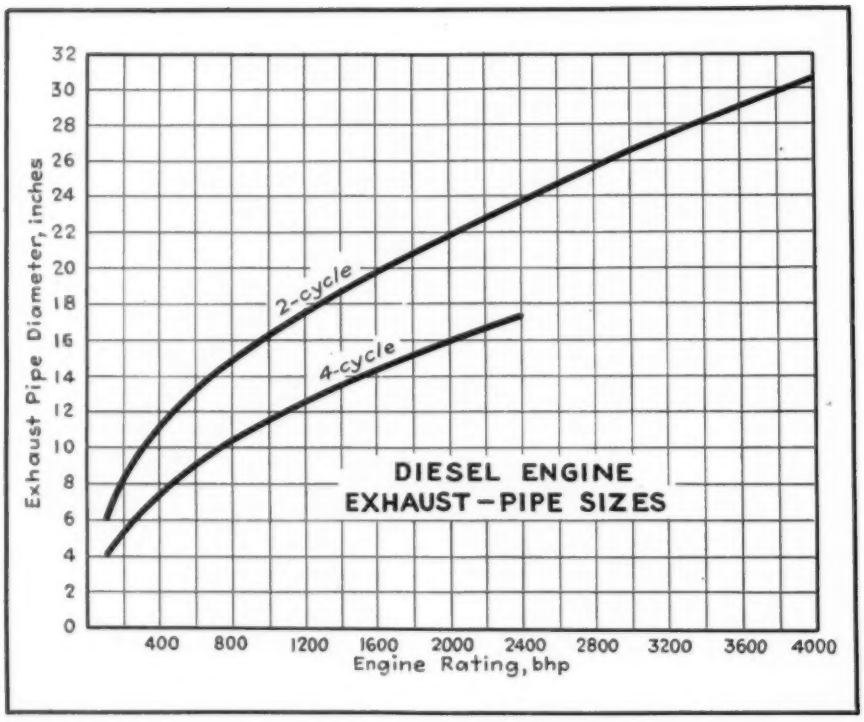



**Fig. 4—Chart gives required exhaust-pipe sizes for various engine capacities**

corrugated or slip-joint expansion fittings of familiar standard types.

Fig. 5 shows typical exhaust assemblies, which fit a majority of installations. In general, *A* represents the preferred solution because it involves a minimum length of piping and a single 90-deg bend. The assembly shown in *B* offers an interference if a traveling crane is to be installed, although it is otherwise satisfactory, being short with only one bend. The layout in *C* involves considerable pressure drop between engine and muffler because of the three 90-deg bends.

Some engines are equipped with individual exhaust pipes for each cylinder. These pipes terminate below the bottom of the engine frame. It is customary in such cases to build a rectangular concrete duct under the engine-room floor and beside the engine foundation. The individual exhaust pipes discharge into this duct. Provision must be made for duct expansion or serious damage may be caused to the engine and generator foundation block.

From the practical operating point of view, several exhaust-system points need checking. See that it is impossible for water, from leakage, rain or snow, to flow back to the engine. Clean exhaust pipes and waste-heat equipment regularly; deposits represent a serious fire hazard and reduce heat transfer in the recovery equipment.

### *Practical Rules*

To summarize: The design of an exhaust system for a diesel engine involves several practical rules which must be followed if a satisfactory system is to result. These rules are as follows:

1. Use pipe with diameter equal to or greater than the values of Fig. 4
2. Make the exhaust line as short as possible
3. Keep the number of bends in the line to a minimum
4. Make provision for adequate expansion in the exhaust line
5. Extend the tail pipe of the muffler above the building roof and bevel it at an angle of 45 deg, or more

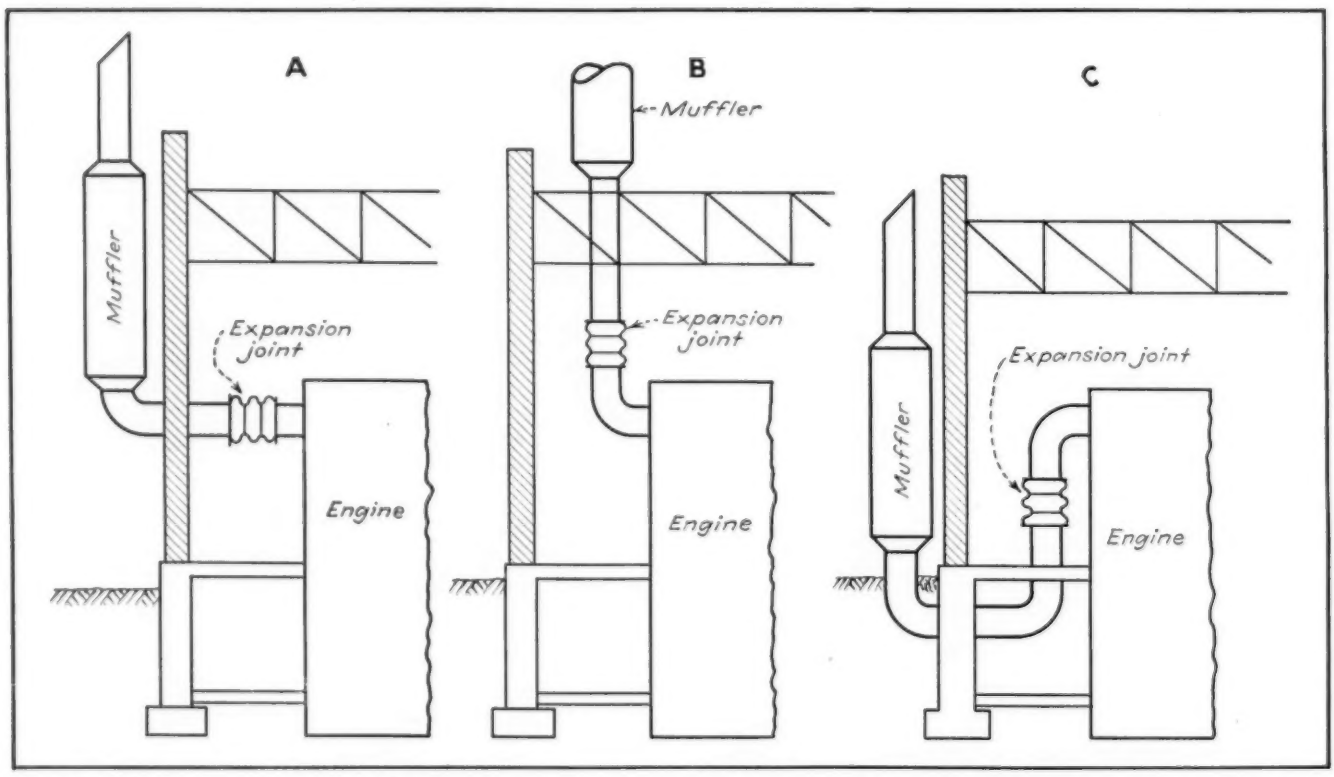



**Fig. 5—Typical exhaust-pipe and muffler arrangements. These are the hookups most commonly found; many others are possible**

# Ingenious Conversion Saves Oil

***Scott Paper Co builds pulverizer house of non-strategic materials, installs secondhand equipment and blows powdered coal through 350-ft pipeline to former oil-fired boilers***

► CONVERSION from oil- to pulverized-coal firing at the Scott Paper Co plant at Chester, Pa., represents a large saving in oil consumption (350,000 bbl per year) and insures continuity of production in the critical months ahead. As in most conversions, supplying the fuel to the boilers presented the major problem, complicated in this case by the fact that no room for pulverizer equipment existed in the boiler house and location of production machinery prevented extension. Transporting coal by compressed air and resorting to simplified coal storing and handling procedures made the conversion possible.

Present boiler plant includes one Babcock & Wilcox integral-furnace boiler rated at 125,000 lb per hr, installed in 1936, and one Combustion Engineering type VU of the same capacity, installed in 1938. These boilers generate steam at 600 psi, 750 F, while a third 85,000-lb-per-hr unit operates at 275 psi. Only the two large units will be converted.

Two boilers can carry all steam load if part of the electric power load is carried by purchased power from the Philadelphia Electric Co. Purchase of power was initiated more than a year ago as an oil-conservation measure when a shortage first became evident.

### *Lower Efficiency*

This arrangement is not the most efficient possible because it involves cutting load on one condensing-extraction turbine to that representing process-steam requirements. By reducing steam flow to the condenser to a minimum, load that would have been generated by oil-produced steam is brought in from the coal-fired utility plants.

As can be seen from the property map in Fig. 1, expansion of production machinery has completely blocked off the boiler house, making impossible any extensive addition in that location. By building a pulverizer house on the opposite side of Market St several hundred feet away from the boiler house, Stone & Webster Engineering Corp, consultants, have devised a storage-type pulverized-fuel system in which pulverized coal will be blown through a pipeline to the boilers.

Coal will be stored in the area at the left side of the slip, Fig. 1, on a property already owned by the paper company. Coal, delivered by rail, will be handled by a portable unloader if priority on the equipment can be obtained. Hand loading may have to be employed if equipment cannot be had. The pile will be compacted by horse-drawn scrapers.

It is planned to build a timber bridge across the slip, as indicated in Fig. 1, and coal will be carried in horse-drawn carts from the storage area to the pulverizer house. From the carts, coal will be dumped into a concrete hopper and then lifted by bucket elevator to a scraper conveyor running across the top of the pulverizer house.

The scraper conveyor discharges into three 100-ton raw-coal silos which feed

(*Continued on page* 146)

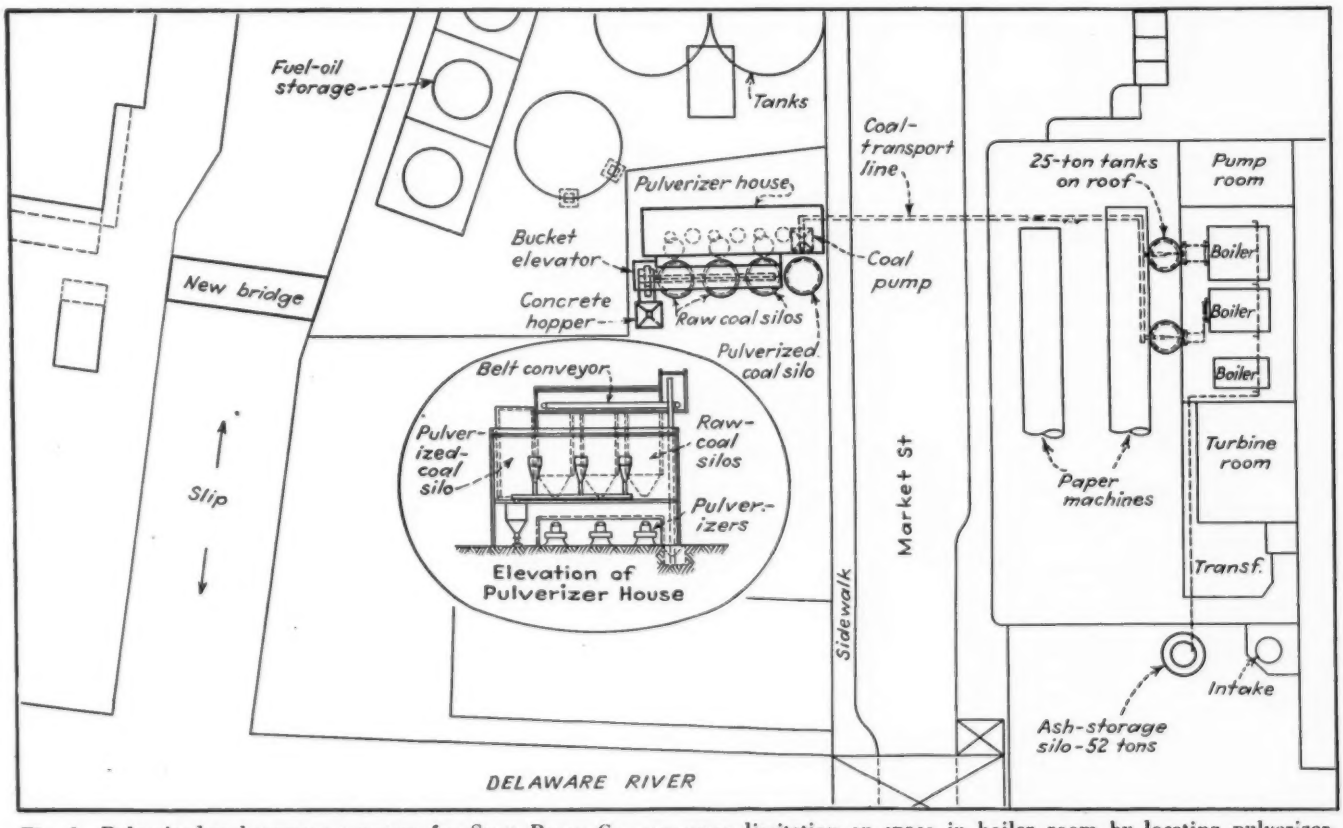



**Fig. 1—Pulverized-coal transport system for Scott Paper Co overcomes limitation on space in boiler room by locating pulverizer house across street. Moving coal from storage across slip will require timber bridge and horse-drawn carts**

# More Power Water Flows Into the Great Lakes

***Projects now under construction will divert 5000 cfs of water that normally flowed into Hudson Bay, into the Great Lakes for power generation***

►WHEN THERE WAS PUBLISHED an article (POWER, March 23, 1926, p. 464) describing a suggested diversion of the Ogoki and Albany Rivers in northern Ontario into the Great Lakes it probably was looked upon as a fine idea, but a long way from being put into use. However, actual diversion will start in 1943. So you never can tell what will happen in these rapidly moving times.

The original scheme proposed the construction of two great dams on the Ogoki and the Albany Rivers to form a sixth great lake, as in Fig. 1, to divert the flow of these rivers from James Bay into Lake Nipigon, down the Nipigon River into Lake Superior. This plan was estimated to form a lake 1500 sq mi in area, provide a diversion of between 20,000 and 30,000 cfs, develop 1,000,000 hp additional on the Nipigon, Niagara and St. Lawrence Rivers and cost $150,000,000.

Shortly after this diversion was suggested engineers of the Hydro-Electric Commission of Ontario began to investigate its possibilities. Data gathered in succeeding years from exploratory trips and other facts and figures showed that a diversion of the Ogoki River was not only physically possible, but that it was economically sound if and when such a diversion might be required. The unprecedented demand for power in Ontario because of the rapid increase in war production provided the stimulant to start the Ogoki project.

### *Increased Diversion*

Through a friendly agreement with the United States, Canada was permitted to utilize additional water at Niagara Falls in existing plants to increase power output for war purposes. This agreement provided that this flow should be equivalent to that which would be added to the Great Lakes by the Ogoki and Long Lake diversions.

Early in the winter of 1940 actual construction work started and the project will go into operation next year, as described by David Forgan, construction engineer, in June *Hydro News*.

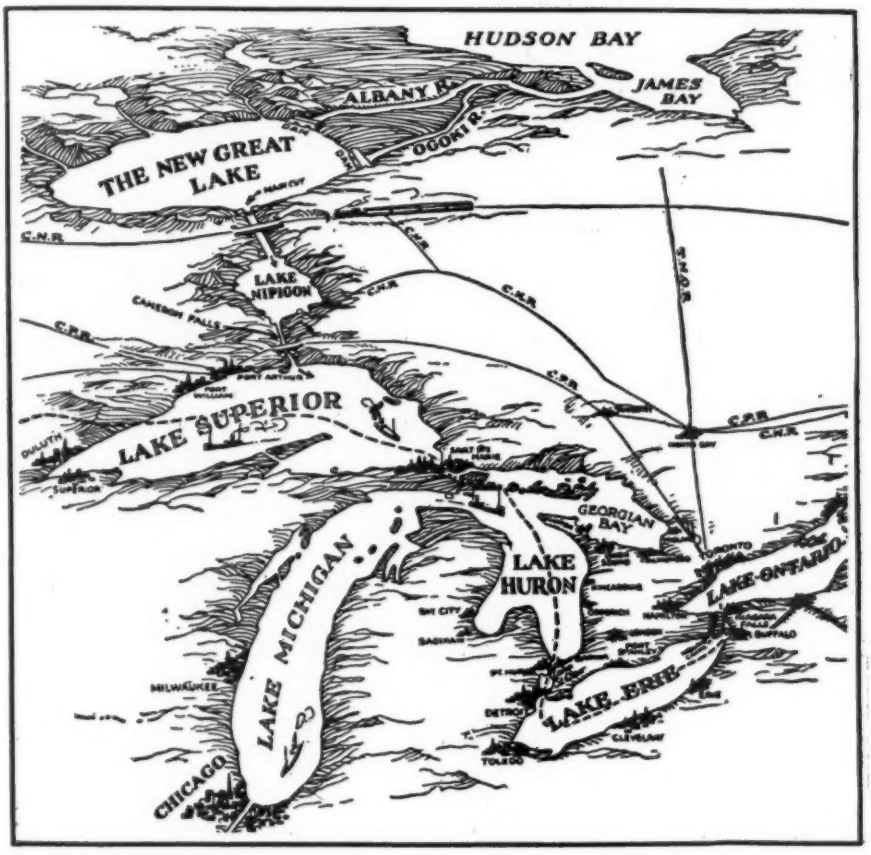



**Fig. 1—The first suggested project to divert water into the Great Lakes proposed a sixth great lake to be formed by damming both the Albany and the Ogoki Rivers**

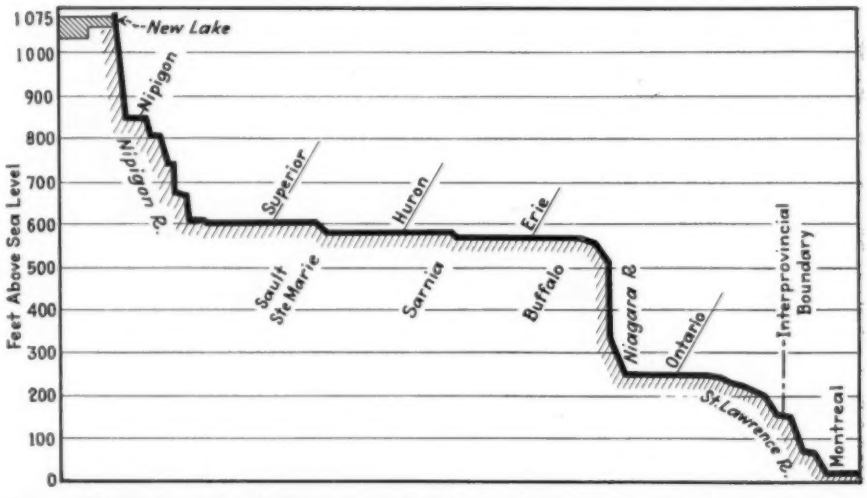



**Fig. 2—Profile from Ogoki River through Lake Nipigon, the Great Lakes to Montreal**

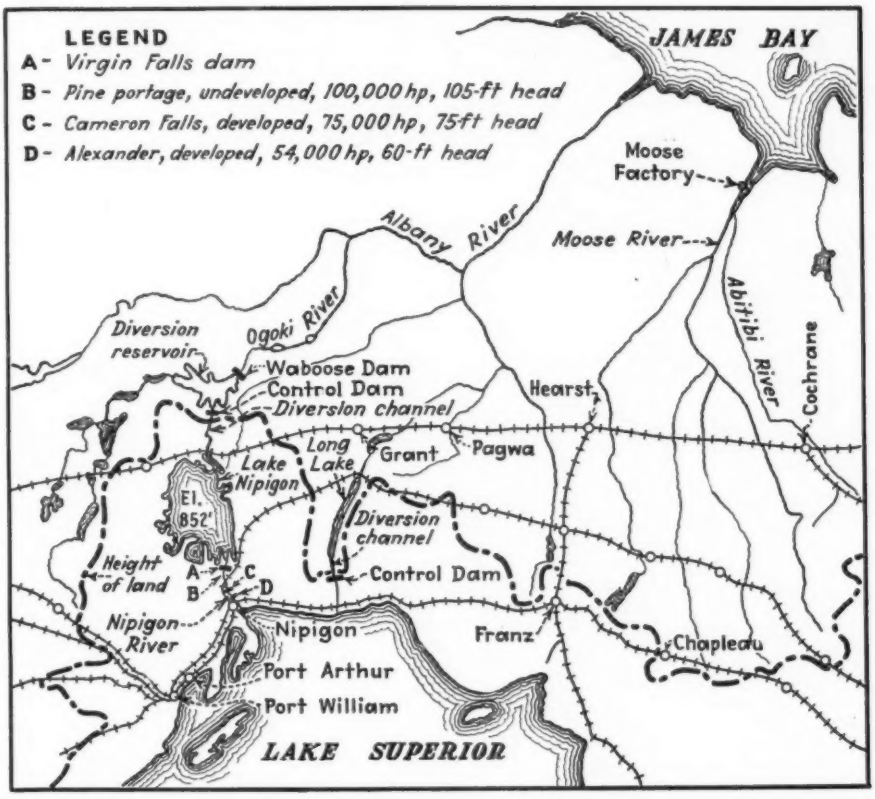



**Fig. 3—Present diversions into the Great Lakes are from Ogoki River and Long Lake**

At the head of Waboose rapids, work on the main dam is well advanced and when completed the dam will be 50 ft high and 1700 ft long. Two auxiliary dams will close low points in the contour. These and other auxiliary dams will create a reservoir 30 mi long, 120 sq mi in area, of which 40 sq mi is lake area and 80 sq mi newly flooded land.

A channel cut through the height of land diverts the flow from the reservoir into a small river and to Lake Nipigon. At the entrance to the diversion channel, control works provide for a flow of 10,000 cfs. As shown in Fig. 3, water from Long Lake at the head of another branch of the Albany River is also being diverted through the Aguasabon River into Lake Superior.

### *Ogoki to Montreal*

From the Ogoki divide to Montreal Harbor the water falls 1040 ft, Fig. 2. Approximately 580 ft of this fall is wholly or partially developed. On the Nipigon River 135-ft head is developed in two plants of the Hydro Commission at Cameron Falls and Alexander Landing. An additional 100 ft can be developed at either one or two sites.

At these developed and undeveloped sites on the Nipigon River an average of 4000 cfs diverted from the Ogoki River would increase the continuous power of the river 90,000 hp. On the Aguasabon River, down which diversion from Long Lake flows, 1000 cfs will develop 20,000 hp at sites yet undeveloped. Averaging 5000 cfs, the combined flows from the Ogoki River and Long Lake can be used to develop 10,000 hp at Saulte St Marie, 150,000 hp on the Niagara River, 40,000 hp on the St Lawrence River in Ontario and 50,000 hp on this river in Quebec, a total of 360,000 hp from the two diversions to bring water to where it is needed.

# Missionary Builds Power Plant in Belgian Congo

► How an American missionary used his college training as an engineer to build a hydroelectric power plant deep in the Belgian Congo is revealed in a series of letters to an American electric equipment manufacturing company that supplied most of the machinery.

The missionary is Dr George W Carpenter of Saratoga, N. Y. and an engineering graduate of Union College in 1921. He completed theological training at Rochester Theological Seminary and in 1927 went to the Belgian Congo as a missionary. He was stationed there until 1937, when he received a doctor's degree from Yale University.

Dr Carpenter was the only white man in the force which built the plant at Banza Manteke, a small settlement near the Congo River. It was built to supply light and power for his Baptist mission there.

Electrical equipment, including a 25-kva generator, transformer, switchboards and lightning arresters, was carted over primitive roads to the site in a trailer built by Dr Carpenter.

"We had to fall back on elementary methods," wrote the missionary in a recent letter. "All the earthwork was done by pick and shovel and wheelbarrow; and the drilling of rock by plain bar and sledge hammer; and the blasting by time fuse.

"I was the only white person on the job, with about 60 Africans, none of them familiar with any job of this kind. One or two were good carpenters and mechanics, one a fair blacksmith and three very good masons. All the mechanical and electrical aspects of the work they had to learn as they went along. The foreman, who was already a good mason and learned the mechanical side of the work very readily, now heads the plant as operator and caretaker."

Before the equipment could be installed, a canal several hundred feet long had to be constructed, to obtain a waterfall of sufficient height to operate a generating station on a practical basis. A cut through a hill, composed mainly of limestone and shale, was made, the stone thus quarried going into construction of the generating station building beside the waterfall. Negotiation with a Congo railroad company resulted in permission to use rails from an abandoned spur as poles for the transformers.

In spite of such primitive construction problems, within a few months after arrival of the equipment from America, the plant was operating at full capacity, delivering current for light and power to the church, school, hospital residences and other buildings at the Banza Manteke Mission.

In addition to conducting his Baptist mission, Dr Carpenter is secretary of the Protestant Council of the Congo, made up of representatives of many denominations. He also finds time to give the natives instruction in lumbering, plumbing and similar practical mechanical subjects.

# How to Improve Forced-Air Layouts

***J D Constance, PE, shows how location of grilles and registers, type of system installed, method of control and zoning arrangement affect degree of comfort obtained and gives practical suggestions for improvements***

► FUEL RATIONING forcibly turns attention to the ever-present problem of producing desired comfort conditions in heated spaces, with minimum expenditure of fuel. Many heating systems, particularly those installed some years ago, offer possibilities for real improvement in this respect.

In forced-warm-air heating systems, satisfactory and comfortable results depend to a large extent on the proper control of air movement. This article shows how the air movements produced by the heating equipment react with conditions in the heated space to produce drafts and discomfort or to counteract draft-producing factors and create comfort. With the thought that presence or absence of drafts is perhaps the most important single factor in producing satisfactory results with warm air heating, location and design of grilles and registers, heating-system characteristics, automatic control methods and zoning are all examined in relation to air movement.

Draft conditions at windows and along exposed walls of low heat resistance form a major problem in forced-air systems. To illustrate, consider a simple enclosure with a common source of air distribution, as shown in Fig. 1. As air leaves the supply grille, part of it travels along the ceiling, drops down along the exposed wall and window and returns along the floor to the return register. The remainder of the supply air mixes with room air, setting up a secondary circulation, and finally passes out through the return register.

### *Exposed Walls Cool Air*

The exposed wall produces a cooling effect on the heated air that strikes it and this air mixes with cold infiltrated air and is further chilled. Under these conditions, temperature may fall well below design room temperature in an area immediately close to the window, marked by *A* in Fig. 1. The temperature of this air will rise slightly, depending on the extent of its mixture with the room air and on the floor temperature. Air temperatures at *A* and along the floor will determine the degree of draftiness and the worst trouble area will be at *A*. It has been found that several factors determine the conditions at *A* and along the floor.

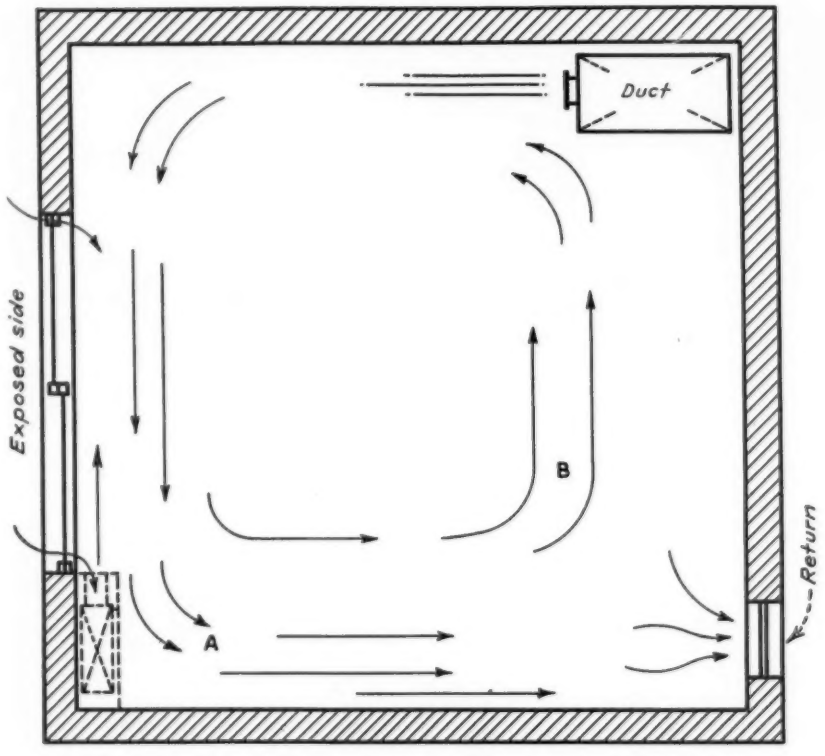



**Fig. 1—Cooling effect of exposed walls and infiltration of cold air around window causes temperature close to window (at *A*) to drop below design conditions**

The volume of air that passes over the exposed wall and window is fixed by the requirements of the cooling load if the system is designed for summer conditioning, as are most modern forced-air systems. In this case, raising air temperature to 135 F in winter takes care of the heating load. The total volume being fixed, by these or other considerations, that part of the supply air passing over the window becomes a function of the type and location of the supply grille and of the outlet velocity. Obviously, the greater the volume and temperature of the air striking the exposed wall and window areas, the less will be the draft effect produced. These points should be given full consideration in selecting the method of air distribution for the cooling cycle.

This method of heating, using only heated air from a central duct system, is generally called *blast* heating. It has its limitations and is recommended only in special cases. There are many existing blast-heating jobs in operation which have proved unsatisfactory because of drafty conditions at the windows. These can be materially improved by the application of the points outlined above. According to data obtained from practice, many jobs with drafty conditions at the windows have been made satisfactory by increasing the fan speed and the air throw so that a greater proportion of heated air reaches the exposed areas and blankets the wall and window. This solution is limited by the need to avoid too-high air velocities which might prove annoying in the cooling season. Supply grilles with adjustable horizontal face vanes and air scoops directly behind the grille face provide handy control of volume, throw and direction.

Size and kind of windows directly affect draftiness. Of course, large windows give more trouble than smaller ones because of greater cold area and

infiltration and because of greater difficulty in effectively "air-blanketing" the surface. Infiltration depends on the "fit"—leakage through a poorly fitted single window may cause serious drafts while that through a tightly fitted window with weatherstripping or storm sash may be of little consequence.

Building up internal pressure by taking in outside air at the fan does not necessarily mean negligible infiltration. On windy days leakage inward remains an important item, especially at windows on the windward side. Although effect of outside-air infiltration is counteracted by building up a positive air pressure in the conditioned space for summer cooling, it can still cause serious trouble during the heating season because of its concentrated and localized effect in the area immediately adjacent to the window. Heat loss by transmission through the glass itself can also prove serious if windows are not double-glazed or storm-sashed.

Severity of the climate determines, to a large extent, whether or not the factors discussed above play an important part. Infiltration and transmission losses that would not produce objectionable drafts in a mild climate might cause severe dissatisfaction in a severe climate. Although drafty windows never prove desirable, it is only under more or less severe conditions that they form a real nuisance.

### *Return-Air Intakes*

For winter heating, always locate return-air intakes at the floor line to pull out the cold air that gathers there. Putting the return on an exposed wall, or under a window, removes cold air immediately instead of allowing it to cross the floor and produce drafts. However, these desired locations are not always available.

Velocity through return grilles should be limited to 300-400 fpm but may go to 500 fpm if location will not cause drafts objectionable to occupants. When a main return grille connected to a duct is located in a corridor of a row of offices, never permit the return from each office to be made by doors being left ajar or by open transoms over the doors. It is under these conditions that stratification of cold air at the floor persists, with an attendant draftiness.

So much for the direct relation between air supply and drafts. What is the relation between the kind of heating-system layout used and the presence or absence of drafts? We have already mentioned blast heating, with the entire load carried by the duct system. To reduce the effect of drafts at windows, as discussed above, air must be discharged toward the windows at a velocity sufficient to set up enough secondary air flow in the room to maintain movement in the occupancy zone at from 15 to 50 fpm, as well as to maintain small temperature differentials between floor and ceiling. The effect of draft at windows is so serious that blast heating is not recommended in the usual air-conditioning job except in two cases.

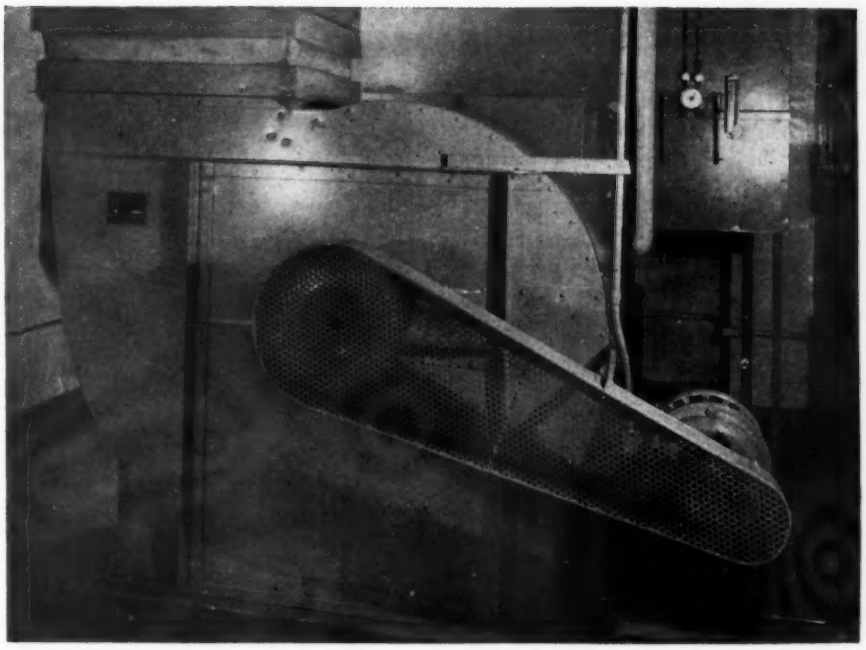


**Fig. 2—Booster fans play an important part in matching heat supply to heat load**

In one case, the air-supply ducts discharge air upward over the window surfaces, thus eliminating the draft effect, as would radiators. The air stream fans along the outside wall, thereby blanketing that cold surface, and the temperature of the stream always matches the amount of heat loss from the space. With this arrangement the primary air-stream temperature should not exceed room temperature by more than 4 or 5 F when it reaches the ceiling, at times when the temperature of air leaving the outlets is at a maximum.

The ducts may run along the outside wall on the floor or along the ceiling beneath the floor, with discharge outlets through the floor. Discharge velocity should range from 500 to 550 fpm. As in Fig. 1, the returns are at the floor close to the outside walls. This method of supply is not generally recommended for summer cooling but has worked in several installations. Under ordinary conditions, summer operation means another duct system.

With this blast-heating arrangement, there are no down drafts along the outside to cause discomfort, which sometimes occurs when air blows horizontally from inside to outside wall, especially if radiation is not provided. Also, floor temperatures throughout the room run only a degree or two below control temperature because vertical air streams offset infiltration and down drafts from the windows.

Blast heating can be used where the climate is such that outside temperature seldom falls below 32 F. In such cases, the draft effect at windows is not serious enough to cause discomfort.

### *Split Systems*

A second type of warm-air layout—the *split* system—divides the load between the duct system and direct radiation. That part of the heat load carried by direct radiation may vary from a small portion to the entire load, according to conditions of installation. The amount of direct radiation generally depends on the window exposure, sufficient radiation being used to take care of all window exposures and to balance radiant heat losses from the body to cold walls. Temperature of heated duct air varies according to the heat losses in the conditioned areas. Return air leaves through grilles located at floor level.

Several distinct advantages of split systems lead to recommendation for the large majority of installations. Such a system largely eliminates trouble caused by drafts at windows. Direct radiation takes care of the window exposures and blast heating carries the

remainder of the load or divides it with direct radiation.

Split systems are adaptable to automatic temperature control. Installations having a relatively small amount of direct radiation, with the greatest part of the load carried by blast heating, possess most of the characteristics of blast-heating jobs. Here the problem of control is relatively simple if the principles outlined under "zoning" below are followed. The radiation can be either manually or automatically controlled but it is a small part of the job. The main control function lies in the blast heating.

Where direct radiation carries the major share of the load, automatic control on both direct radiation and the blast system becomes important. The control should be so arranged that the direct radiation comes on first followed by heat from the air system, as required to balance the load. If the direct radiation is manually controlled, it may require considerable manipulation to prevent overheating during "in-between" seasons.

As will be explained under "zoning" intermediate-season operation often requires heating in one zone and cooling in another, simultaneously. Split systems are well adapted to meet this situation, because temperature of main air supply to all zones can be lowered sufficiently to provide needed cooling for the zone with the greatest cooling load and radiator heat can be supplied in the other zones to balance the load in each case.

### *Intermediate Operation*

If the entire heating load is carried by direct radiation, ability to supply cooled air to meet the cooling load in one zone during intermediate-season operation makes such an installation a split system in effect. The direct radiation in zones requiring heat offsets the cooling effect of the air supply. In such a case, the only blast-heating requirement is to heat the outside air or the mixture of outside and return air. The heating coil need only be able to bring this air to room temperature at peak load.

The only real difference between this special case of the split system and the "winter-tempering" systems described below lies in the fact that in winter tempering the thermostat controlling the heater stands on the discharge side of the heater and thus maintains a fixed air temperature, whereas in this case the thermostat reacts to room temperature and can vary air temperature to supply cooling if needed.

An important advantage of split systems grows out of the ability to correct old systems. When an engineer applies air conditioning to a job having an existing heating system, he often finds that the existing system is faulty and that satisfactory heating never existed or resulted only from skilful manipulation. In such cases, satisfactory operation often results from reducing the direct radiation to a point where it is inadequate to meet the load. Blast heating, under automatic control, then makes up the deficiency. Thus overheating or unsatisfactory control can be corrected and conversion made to automatic operation. In determining the amount and location of direct radiation to be turned off the engineer must exercise care to find the most troublesome areas and not to leave exposed windows without a source of heat to offset chilling effect.

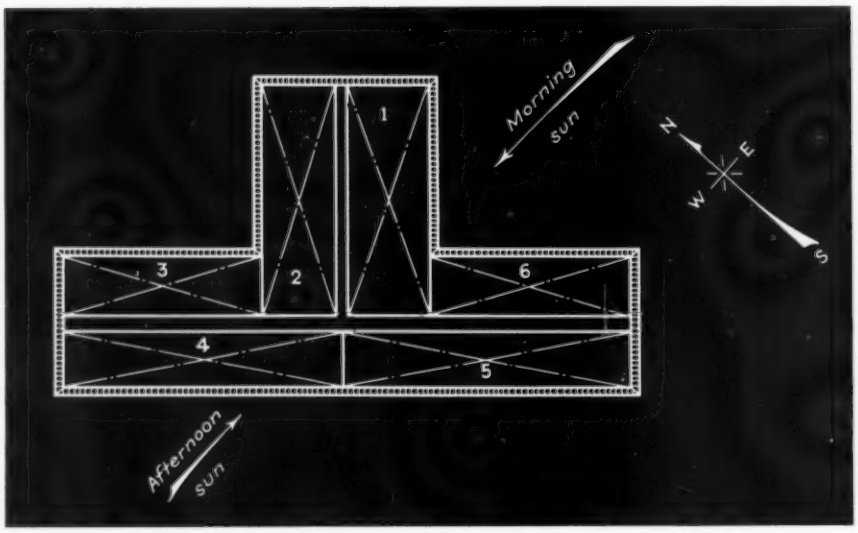



**Fig. 3—To allow for shifting sunshine and prevailing northwest wind, group areas 1 and 6, 4 and 5, and 2 and 3 into separate zones, each with its own control**

The third type of forced-air layout combines direct radiation for heating with air supply for ventilation and is known as *winter tempering*. Air temperature is fixed at approximately room temperature (70 F) and is supplied for ventilation and humidification only.

Several disadvantages make winter tempering less desirable than the split system. Operation during the intermediate seasons can prove troublesom . As explained under "zoning", below, intermediate-season operation often requires simultaneous heating in one zone and cooling in another. Also sudden changes in outside temperature might require first heating and then cooling even in the case of an air conditioning unit serving only one zone. To take care of the condition, the engineer must (a) reset the tempered air thermostat to a lower temperature so that cool air can be supplied when necessary or (b) must change over from winter to summer control so that unheated outside air can be used for needed cooling.

Both methods may require considerable manipulation and it is the frequency of these changeovers that makes winter tempering undesirable. It is possible to overcome this disadvantage to some extent, especially in localities where the winter season is not subject to constantly recurring mild and cold spells, by not changing over to winter operation until the season is far enough advanced so that cooling will not be required in any zone because of either sun or internal load. This is done in almost all cases.

Winter tempering lacks easy control: room-temperature control is only possible through manual or automatic control of direct radiation. On installations with existing radiation, automatic control of each radiator will probably be necessary, because it is rare that the piping system is so arranged that radiators can be grouped with a single control for each zone. While it is true that individual control of each space can be attained by manual operation of radiation, in practice this requires too much personal attention.

### *Tempering Advantages*

Winter tempering offers these advantages: (1) The duct system is not a source of heat and so may be designed for best summer operation without regard for winter. Return grilles may be located above the floor or at the ceiling if desired. (2) Radiators eliminate drafts at windows. (3) Heating is entirely independent of the fan system and interruptions such as power failures will not cause undue discomfort.

The above advantages apply equally to the special case of the split system previously mentioned. When applying winter tempering to a job with existing direct radiation, bear in mind that the air-conditioning system will always be expected to make up for all the deficiencies of the present heating plant, which in some cases will be serious. Hence it should not be taken for granted that the existing direct radiation is either adequate or satisfactory. Some trouble may be experienced with overheating in the vicinity of radiators. This can be offset by shields along the side of the radiators. Of course, this is a makeshift and does not lend itself to economical control.

### *Partial Panel Heating*

Recently, the problem of achieving winter comfort in air-conditioned installations has been tackled on a new slant. To eliminate local sensations of warmth or coolness from interior partitions to outside walls, areas at the sides of windows carry buried heating pipes to maintain 70-F wall temperature. With this arrangement, the average radiating temperature of windows and outside walls limits the rate at which the body loses heat by radiation, thus eliminating a major source of discomfort in rooms heated largely by convection.

In one installation of this kind (see POWER, October 1940, pg 93), the wall construction plays an important role. Behind the outer wall come two 1-in. layers of corkboard with seams staggered to reduce air leakage to a minimum. Between the cork insulation and the inner wall, a system of 1-in. bare copper pipes loops around and under the window openings. Enameled steel forms the inner wall surface. In winter, hot water flows through the tubes to balance heat losses through windows and walls. This supplementary heating makes it possible to utilize, comfortably, floor space right up to the walls, adding about 8% to the useful floor area.

There is also a direct relation between the control method used, the forced-air layout, and the degree of comfort attained. Automatic temperature control can be applied to an installation formed of a number of heated spaces served by a central fan system in any one of several ways. Control of each individual space usually becomes impractical in an extended system because of complexity and high cost. Automatic control of return air to the fan represents a more common solution. This arrangement maintains temperatures which are averaged for all spaces and not necessarily the desired temperature in any one space. It proves successful when all spaces offer similar heat-loss conditions, both internal and external, with respect to time and amount. In other words, each space should reach its peak load at the same time. This condition seldom appears on sizable jobs and represents one of the main reasons for the failure of controls to maintain satisfactory temperature conditions on such jobs, except in a few of the many spaces.

Another solution involves locating the control instruments in a representative space, sometimes called the "key room". This method suffers the same limitations as control by return-air temperature. The only difference lies in the fact that control by return air actually averages all the room temperatures while the "key room" method seeks to arrive at average conditions by preselecting an average space.

Difficulties experienced with these and similar methods of control lead to the use of *zoning*. Zoning breaks up an installation into sections or zones in which conditions of loading, both internal and external, are similar. The installation is then designed and laid out so that each zone can be individually controlled. Temperatures of all spaces in a given zone vary alike, making it possible to control satisfactorily by either return-air temperature or by locating control instruments in a representative space in the zone. The importance of zoning cannot be over-emphasized and no installation should be laid out until careful consideration has been given to zoning.

### *Zoning Applications*

In the application of zoning, give first consideration to external spaces exposed to sun and wind. Spaces exposed to sun may require little or no heat at times when shaded spaces require considerable heat. This is especially true of spaces with a large amount of glass exposure, such as are found in office buildings. Zoning of external spaces depends on the following considerations:

Spaces exposed to the sun should be zoned against shaded spaces. In Fig. 3, areas 1, 4, 5 and 6 are exposed to the sun and areas 2 and 3 are always shaded. Thus, from this consideration alone, areas 1, 4, 5 and 6 could be combined in one zone and 2 and 3 into another.

Zoning should provide for sun movement during the day, and the resulting change in the heat load of the various spaces. In Fig. 3, areas 1 and 6 receive sunlight in the morning only while at the same time areas 4 and 5 are shaded. In the afternoon, the position reverses. Thus areas 1 and 6 should make one zone, to be controlled independently of the zone comprising areas 4 and 5.

Spaces with surfaces exposed to winter prevailing winds show a higher heat loss than similar spaces not so exposed. Wind velocity constantly changes and the difference in load between exposed and unexposed areas also changes constantly. Thus areas exposed to wind must be zoned separately. In Fig. 3, with a northwest prevailing wind, areas 2 and 3 must have greater heating capacity as well

(*Continued on page* 144)

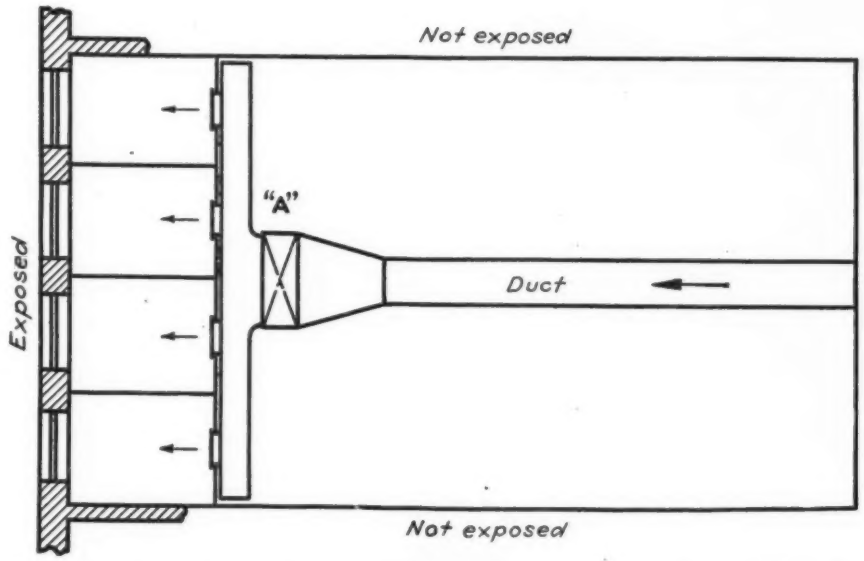



**Fig. 4—Installing a booster heater at *A* to supply heavy load in exposed offices with little internal load permits balancing these requirements against the interior spaces where a heavy population load reduces heating requirements**

# Chemical Removal of Scale From Heat-Exchange Surfaces

***Exact knowledge of scale composition aids selection of best solvent for rapid removal of scale accumulations. Guy F Williams* explains the technique of using inhibited acid solutions***

▶ WARTIME PRODUCTION SCHEDULES place added emphasis on reducing outage time, prolonging life of equipment and using a minimum of replacement materials. Cost of enforced shutdown to repair or replace vital industrial equipment is no longer measured in dollars, but in disrupted production schedules, pounds of steel and other difficult-to-obtain materials. Any method of improving plant efficiency or minimizing length of shutdown should command attention of operators.

One troublesome contributor to inefficient operation of industrial equipment is accumulation of scale deposit on heat-exchange surfaces. In steam-generating equipment, scale not only wastes fuel but can also cause tube failure from overheated boiler metal. The latter condition increases in importance in high-pressure units that operate at high rates of evaporation. Where scale has been allowed to build up, it must be removed mechanically or chemically.

Mechanical methods usually require extended outage of the equipment and much hand labor. Chemical methods prove quicker and more effective in reaching remote or tortuous parts of modern heat-exchange equipment.

Chemical solvents have been employed for many years in the petroleum industry to increase porosity and permeability of geological formations that contain oil and gas, thus increasing the yield from the well. Similar solvents have also been used to remove scale deposits from oil-field boilers, cooling jackets of internal-combustion engines[1] and other related oil-field and oil-refinery equipment[2] with success. Experience gained in these operations has been valuable in adapting chemical-removal methods to industrial scale problems.

### *Chemicals Offer Advantages*

Chemical methods offer several advantages over mechanical cleaning: (1) eliminate dismantling because solvents can be circulated through existing pipe connections, (2) solvents penetrate otherwise inaccessible locations wherever steam and water normally flow, (3) operating results indicate that scale deposition is slower on a thoroughly clean metal surface than on one which has been only partially cleaned mechanically, (4) actual operation of chemically descaled boilers has proved reduced maintenance as compared with manual cleaning, and (5) solvent cleaning is quicker and requires less labor.

Most industrial scales are sufficiently soluble to be effectively removed by readily available solvents. Chemical removal, however, offers no cure-all, because success depends entirely on the scale composition. Occasionally a totally insoluble scale is found that can be removed only by mechanical methods.

Scales with solubilities as low as 40% can often be removed chemically because the dissolving action of the soluble portion tends to disintegrate the less soluble elements which can then be flushed away with water. An exception to this would be a laminated deposit of alternate soluble and insoluble scales where an insoluble layer adjoins the metal surface to be cleaned.

It is most important to have exact knowledge of scale composition. Usual practice employs a small portable test set to obtain a preliminary rapid solubility check of a scale sample. If the sample exhibits poor solubility characteristics in this test, it is then subjected to complete chemical or x-ray diffraction analysis[3]. The latter, used more

* Dowell, Inc. a subsidiary of Dow Chemical Co.

**Table I—Types of Heat-Exchanger Scale Deposit**

| NAME OF SCALE | X-RAY ANALYSIS | WHERE FOUND |
|---|---|---|
| Hydroxy-apatite | $Ca_{10}(OH)_2(PO_4)_6$ | Boiler |
| Pectolite | $4CaO{\cdot}Na_2O{\cdot}6SiO_2H_2O$ | Condenser |
| Magnesium hydroxide | $Mg(OH)_2$ | Brine evaporator |
| Iron oxide | Alpha FeOOH | Bubble tower |
| Iron oxide | $Fe_3O_4$ | Oil cooler |
| Iron oxide | $Fe_2O_3{\cdot}H_2O$ | Polymerization cooler |
| Iron sulphide | $FeS_2$ | Gas pipe line |
| Magnesium oxide | $MgO$ | Boiler |
| Noselite | $Na_8Al_6Si_6O_{24}{\cdot}SO_4$ | Heat exchanger |
| Hydrated magnesium silicate | $Mg_3Si_2O_7{\cdot}2H_2O$ | Firetube boiler |
| Analcite | $NaAlSi_2O_6{\cdot}H_2O$ | Watertube boiler |
| Aragonite | $CaCO_3$ | Evaporator |
| Calcite | $CaCO_3$ | Miscellaneous |
| Anhydrite | $CaSO_4$ | Open-box heat exchanger |

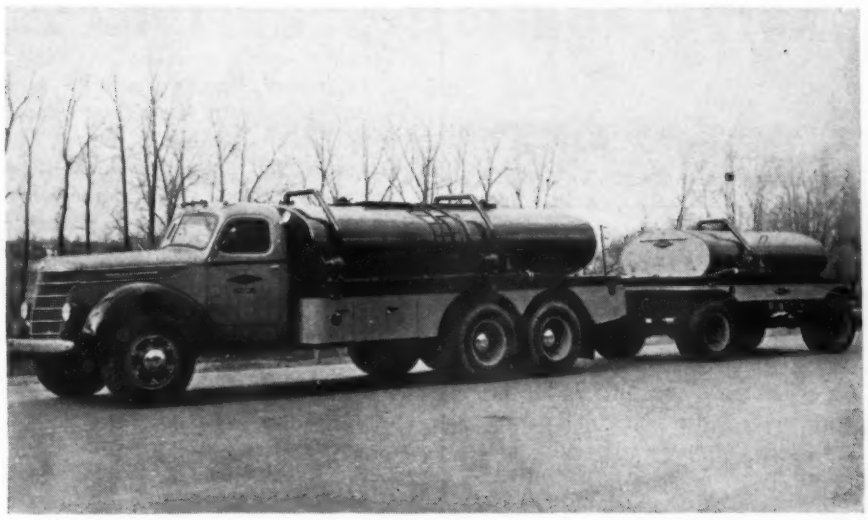


**Fig. 1—Motorized tank units bring chemicals to the vessel to be descaled in sufficient quantity to fill fouled space completely with solutions of necessary strength**

frequently, requires much less time than complete chemical analysis and enables selection of the best solvent more quickly. Some x-ray analyses of typical industrial scales are given in Table I.

Most chemical scale-removal treatments utilize solvents containing acids of varied concentrations to which have been added different types and combinations of inhibitors, to minimize corrosion of the base metal, and other agents to alter the properties of the solvent so that complete removal of the deposit is assured.

As scale deposits vary greatly in composition, it sometimes happens that organic solvents containing no acids are most effective. Only an accurate scale analysis can disclose characteristics of the deposit that lead to the selection of the best solvent.

The temperature of the treating mixture also has a definite effect on the rate of solvents' reaction on various types of scale[4]. Complete removal of the deposit often requires elevated temperature. The temperature needed to secure best results should be determined in advance so that inhibitor selection can be made for maximum protection of the metal surface at the actual temperatures to be encountered.

### *Selection of Inhibitor*

Some inhibitors are more effective on certain metals than others. Information as to the presence of brass, bronze, cast iron, steel or other alloys should always be available at the time an inhibitor is selected. Base metal, as well as the scale characteristics, influences choice of inhibitor.

It is generally necessary to use enough liquid volume to fill the vessel being treated so that circulation of the solvent can be established. This volume of liquid must then contain enough active material to react with all the soluble constituents of the scale deposit. An estimate of the volume of the ves-

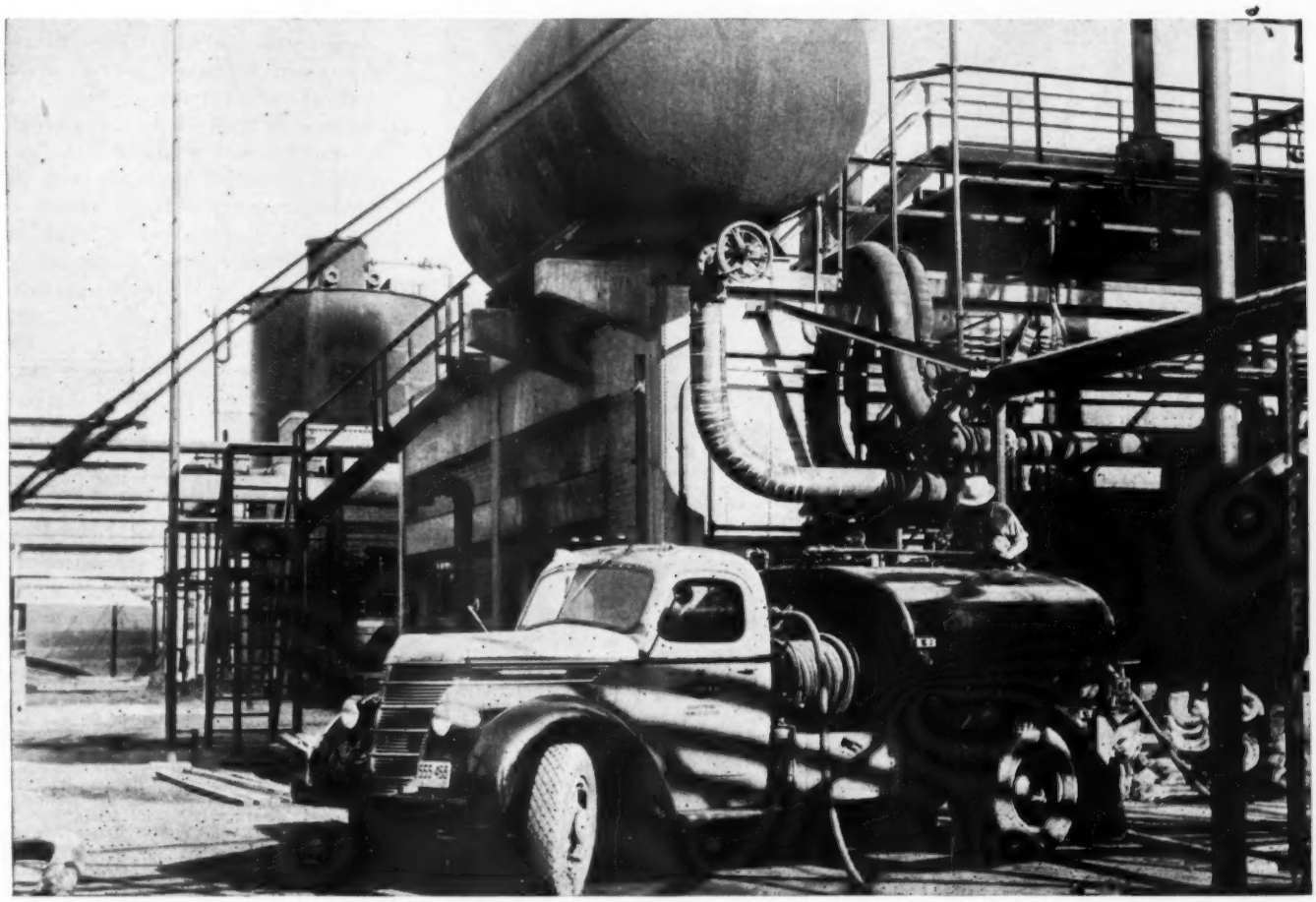


**Fig. 2—Tank unit and hose connections adjacent to outdoor heat-exchange equipment. Only water and steam connections needed**

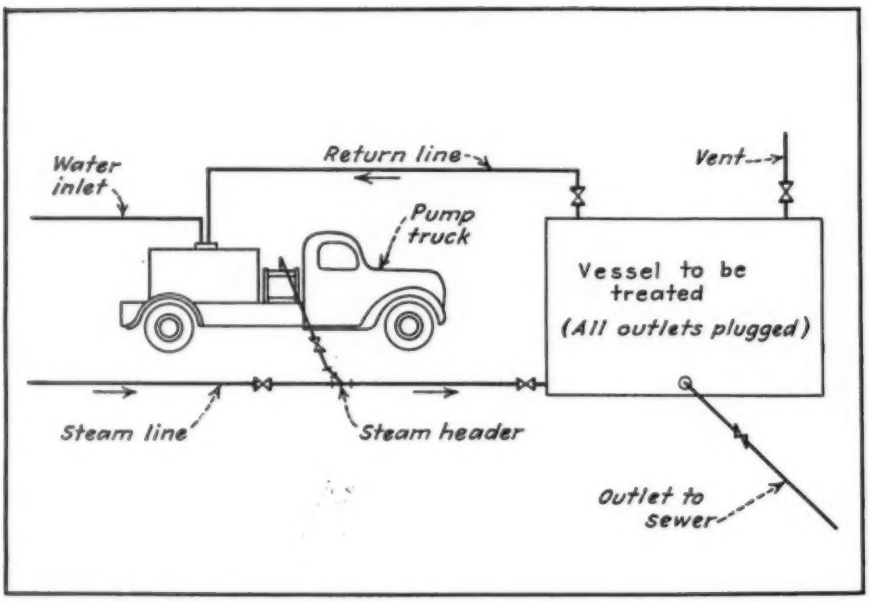



Fig. 3—Line diagram of treating circuit in which the unit to be descaled is isolated by closing valves before solvent is circulated and steam heated from outside source

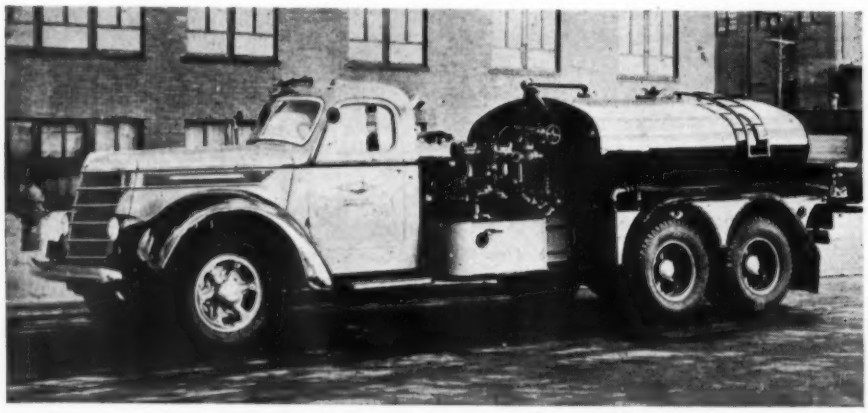


Fig. 4—Large-volume pumps mounted on the truck chassis recirculate chemical solutions to speed the reactions and maintain uniform strength

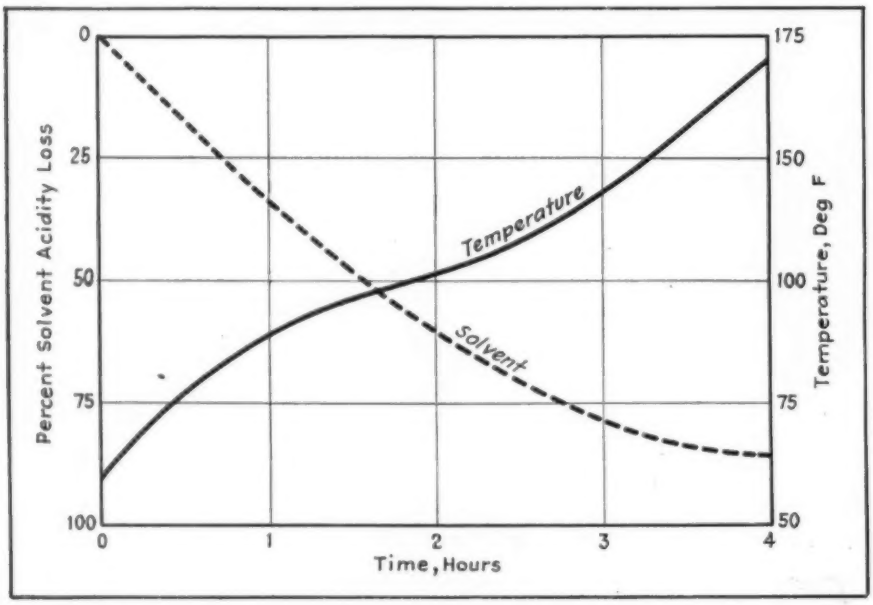



Fig. 5—Periodic sampling indicates solvent strength and temperature. Circulation continues until acidity becomes constant showing that all scale has been dissolved

sel and the amount of scale to be removed is thus essential to effective use of chemical methods.

Treatment chemicals must be transported to the point where they are to be used. Truck units such as the one illustrated in Fig. 1 are convenient. Some of these trucks have large-volume pumps (over 100 gpm) since every scale-removal operation requires at least one pump. While pressure on the vessel is rarely necessary, some of these mobile units can handle liquids up to 3500 psi.

In descaling a heat exchanger, for example, the unit is taken out of service, drained and isolated from the remainder of the plant by closing all connecting valves or blank-flanging piping. Enough solvent at the prescribed temperature is introduced through one or another lower connection to fill the vessel to a predetermined height. All solvent may enter through this connection or at other points, depending on the shape or construction of the vessel. The solvent then circulates from a lower to an upper connection by the truck pump. Circulation brings fresh solvent in contact with the scale at all points and tends to carry out gas formed in the reaction as well as scale deposits sloughed off by chemical attack.

### *Periodic Checking*

Samples of solvent for strength and temperature are taken at regular intervals as the treatment proceeds. Circulation continues until the strength curve flattens out, as in Fig. 5, indicating that all soluble scale has been dissolved. The unit is then drained of chemical, flushed with water, inspected and prepared for return to service.

One important phase of chemical treatment is the "pickling" of new equipment to remove mill-scale and grease before starting operation. Solvents should be selected to suit this specific purpose.

Chemical descaling has already been applied successfully to watertube and firetube boilers of all sizes as well as economizers, superheaters, condensers, air-conditioning units, evaporators, water and steam pipes, brewery equipment, stills, and cooling jackets of internal-combustion engines.

1. Guy F Williams, Chemical Removal of Scale from Compressor Engines, *Oil & Gas Journal*, May 2, 1942.

2. L W Lee, Chemical Removal of Scale from Refinery Equipment, *Refinery and Natural Gasoline Manufacturer*, June, 1940.

3. P E Fitzgerald, X-ray Method of Identifying Types of Scale-forming Deposits, *Petroleum Engineer*, April 1940. C E Imhoff and L A Burkardt, X-ray Fingerprints Scale Deposits, POWER, January, 1942.

4. M E Brines, Scale Removal by Chemical Means, *Power Plant Engineering*, May, 1940.

# Experience Refines Velox Boiler Design

***Ten years of operation and experiment confirm basic soundness of high-duty pressure-combustion forced-circulation design and reveal practical solutions to operating problems.***

► TEN YEARS HAVE PASSED since the first Velox boiler was built. Accumulated experience points to the basic soundness of the principle of operation and has led to practical improvements in design details. This article, based on an extensive report in the *Brown-Boveri Review* (Aug-Sept, 1941) summarizes the modifications made to solve problems encountered in commercial use.

Fig. 1 shows the general layout of a complete Velox unit of modern design. This incorporates the basic features of pressure-combustion, forced circulation, extremely high heat release and heat-transfer rates, and high efficiency. As previously described in POWER (Dec., 1939), flue gas from the boiler drives a gas turbine, which powers an axial compressor. The compressor delivers air for combustion at about 30-40 psi. Combustion gas travels down the boiler interior and enters the steaming elements near the bottom. In its upward passage it flows past evaporator tubes at velocities of 700-1200 fps, producing evaporation rates of more than 100 lb of steam per hr per sq ft.

The circulating pump maintains a circulation ratio of about 10. Water flows upward through evaporator elements into an upper collector discharging into the water-steam separator. Dry steam flows to the superheater. Combustion gas from the boiler goes first to the superheater and then through the gas turbine to an economizer. The feed pump discharges through the economizer to the separator hotwell.

### *Pressure Combustion*

Pressure combustion cuts air requirements down close to theoretical (10% excess air at full load) and allows heat liberation rates of 800,000 to 1,000,000 Btu per cu ft per hr. Reduced gas volume permits low exit temperatures in spite of limited surface so that efficiencies of 90% and more are feasible even at low ratings. High velocities and resulting high heat-transfer rates reduce required heating surface. The result is an extremely compact boiler.

Most design changes of the past ten years center in the evaporation and superheating sections. Original units had fire tubes grouped in a common water tube to form evaporator elements which, placed close to one another, lined the combustion chamber's inner wall. Placing the superheater in the combustion chamber itself, in later designs, eliminated the gas collector and separate superheater housing. Built-in superheaters were developed and a superheater unit placed in each evaporator element (Fig. 2), the latter being lengthened to envelop the superheater unit. To introduce more evaporating surface and to attain high gas velocity, another tube was built into the lower part of the evaporator, giving the hot-gas duct a ring-shaped section.

Relatively narrow gas-duct passages and sudden change in gas-flow direc-

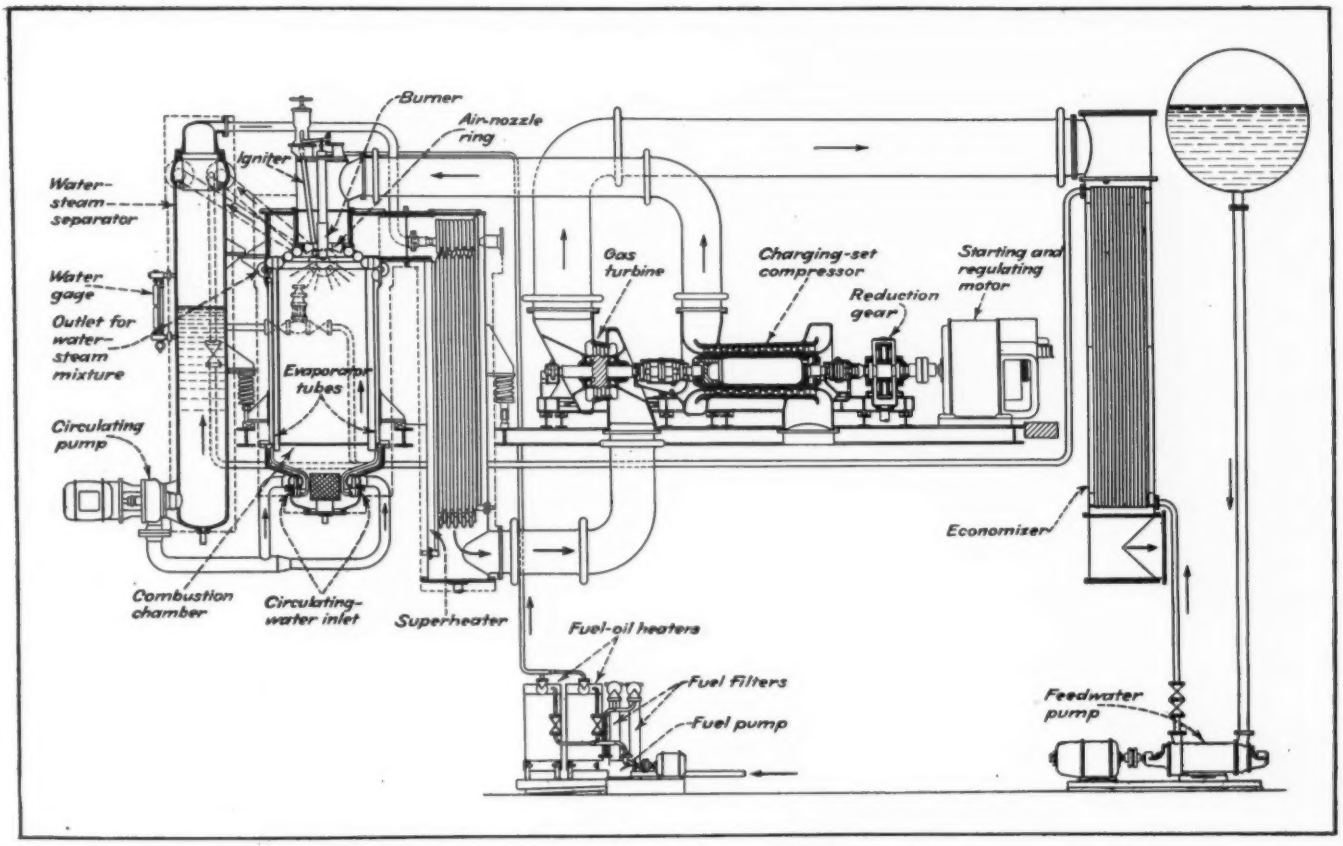



**Fig. 1.—Standard Velox design for outputs of 20,000 to 300,000 lb. per hr, with separate superheater**

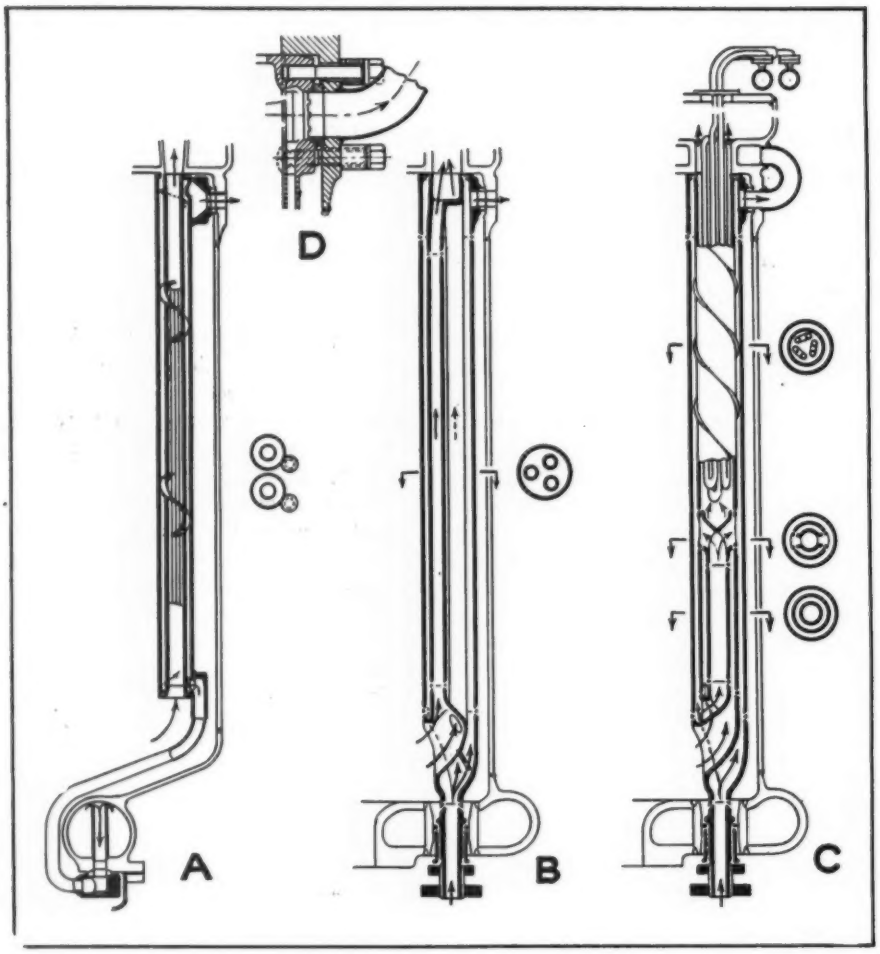



**Fig. 2—Evaporator elements: *A* shows element used today, a single tube without sealing glands and with a common water-steam-mixture outlet for two tubes. *B* is a multi-tube element, with three heating flues in a common tube. *C* shows a built-in superheater in an element with a ring-shaped gas section. *D* is a detail of the water-steam-mixture outlet flange, with lens-shaped seal.**

tion at the evaporator inlet caused choking, with fuels containing considerable percentages of ash or dust. A return to the earlier separate superheater design meets this problem. Figs. 2 and 3 show today's preferred "single-tube" evaporator unit, which requires no stuffing boxes.

In early units, heatproof metal sheeting, carried on some cooling tubes or refractory brickwork, lined the combustion-gas collector, the superheater and the gas duct between. Today, groups of tubes line these surfaces, forming effective evaporation surfaces. Turning the superheater insulating lining into evaporation heating surface increases heat conversion by 25-35%. Gas temperature at superheater inlet can be made as much as 212 F higher, gas temperature at the outlet remaining the same. This permits increasing diameter of fire tubes in the evaporator elements and reducing the superheater surface.

As formerly, superheaters consist of several elements grouped together in bundles of 6-10 pipe lengths (Fig. 3). The pipe lengths are slung in such a way that they are free to expand, being supported by sleeves and pins welded on the tubes.

Economizer designs include a water-tube type in which feedwater flows through the tubes, the latter forming separate elements built into the economizer sheet-metal housing with a cover over its whole length. In gas-tube economizer designs, gas flows through the tubes and the tubes are welded into the economizer end plates.

Improving flow conditions in the gas turbine reduced wear caused by slag in the fuel. Placing dust separators in front of the set, or designing the turbine casing to act as a dust eliminator countered attacks on blade metal.

High rates of heat conversion do not make the Velox especially sensitive to scale formation, nor does rapid vaporization and circulation eliminate the problem. The Velox behaves much like any other high-duty boiler in this respect.

Boiler scale over large parts of the heating surfaces has never been the cause of trouble. Gradual rise in gas temperature, which can be measured at the gas-turbine inlet, reveals presence of such deposits. On the other hand, bulges and tube bursting occurred on certain closely limited parts of evaporator elements, caused by insufficient circulation, by steam pockets and by local scale formation. Building in guide vanes to produce an effective flow of water against tube walls eliminates these troubles.

Carryover of salt into the superheater occurs more frequently than scale formation and has proved troublesome on all modern high-duty boilers. Placing the superheater so that lower tube ends, especially liable to salt deposits, are not subjected to temperatures higher than 1100-1300 F makes the heat-resisting steel tubes practically immune to this danger. The separate superheater is to be preferred from this standpoint; in the built-in type tube ends project down into evaporator elements where gas temperature is more than 1800 F.

Salt deposits which are harmless at moderate temperatures may cause trouble if washing is improperly carried out or the boiler goes on and off the line at frequent intervals. In the latter case, steam condensation causes scale to loosen and drop down. Cloggings

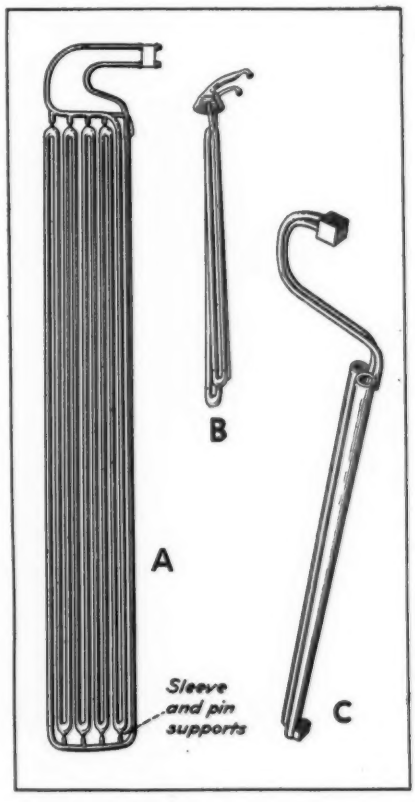



**Fig. 3—*A* shows a flat bundle of tubes for a separate superheater. *B* a bundle for a built-in superheater. *C* shows a double single-tube evaporator element with a common outlet for the mixture of water and steam**

of this kind make themselves felt by increasing superheater pressure drop.

The centrifugal water-steam separator delivers dry steam in spite of its small size and the considerable volume of steam handled. Tests show water content of less than 0.5%. Rough separation surfaces or foaming have caused wetter steam. How much water reaches the superheater when foaming occurs depends mainly on the water level, on the steam outlet, and on the velocity of the water rotating in the separator.

In order to eliminate last traces of wetness from the steam, special steam dryers can be built into the upper part of the water-steam separator. They are made of sheet metal or are cast, and have surfaces in the form of several screw-thread channels. Steam flowing at high speed in these channels throws off drops of water as it goes; these creep down the surfaces and reach a drain pipe through which they flow off.

### *Economizer Corrosion*

In economizers, oxygen content of water may cause corrosion. High flow velocities and smooth surfaces devoid of dead ends prevent oxygen collecting. In this respect, the watertube economizer is superior to the gas-tube. Degassing water effectively prevents oxygen corrosion in both types.

On the economizer gas side, experience does not absolutely confirm expectations that high flow velocity would keep tubes free of drops of water condensed from the combustion products. However, practice shows that the Velox economizer is less subject to gas-side corrosion than the steel economizers of ordinary boilers. When the Velox is under small partial loads, velocity of gas in the economizer falls. To make sure that drops will be blown away in any case, it is desirable to flow gas from top to bottom so that gravity assists the flow force. This arrangement is suited particularly to the gas-tube economizer in which it has been found that the drops only collect at the lower tube edge and only exercise a corroding influence there. For this reason, the tubes are prolonged below the lower end plate and these extra tube lengths are allowed to corrode.

The most reliable protection against corrosion lies, of course, in avoiding too-low temperatures on gas and water sides. On the gas side, modern practice permits going down to about 320 F. Water-side temperatures drop to about 175 F. Both of these figures could be reduced 20% if especially high Velox boiler efficiency is called for.

As previously mentioned, clogging of gas passages led to abandoning evaporating units with built-in superheaters. In the early period of Velox development (1932-35) no trouble of this kind was recorded. As fuel-oil quality became increasingly poor, slag troubles increased. With residue oils, used almost exclusively in Velox boilers, the major trouble grows out of additions of salt, chalk, etc, made at the refinery as part of the process. These impurities remain in the residual oil. According to the quality of the impurities, the ash or slag which separates out after combustion, in the form of tiny melted drops, differs in fusion point, conglomeration, adherence, and solubility.

There is a direct and important relation between gas-flow conditions and nature of slag troubles. When flow is deflected suddenly or if it strikes a partition or an obstacle, the drops of melted slag fly outward and stick to the cold surfaces, gradually forming adhesive crusts or nests of slag. If the hot-gas flue section is small it will choke quickly. If, however, sharp deflections are avoided and high flow velocities only attained when direction of flow parallels smooth tube walls, the drops harden, roll along the flue walls and leave the stack as small particles.

Earlier evaporators with several tubes and non-deflected gas flow never stopped up. The single-tube elements used today, with firetube diameters of about 2 to 4 in., have still less tendency to choke. To use fuel containing much incombustible matter in older plants with small gas sections, the combustion chambers are provided with washing devices. The slag is composed in major part of water-soluble salts and the Velox combustion chamber can be filled with water. The slag dissolves and drains off with the water after a couple of hours. The time during which service is interrupted is short.

It is always reckoned against the Velox that it does not permit benefiting from a high feedwater temperature, obtained by extraction heating, because the economizer cannot be replaced by an air preheater, the combustion air being already heated by compression in the charging blower. However, the efficiency of the Velox is extremely high and elimination of higher steam-extraction points makes the plant much simpler. On the other hand, there is a possibility of improving over-all Velox efficiency by making the gas turbine of the charging set deliver power.

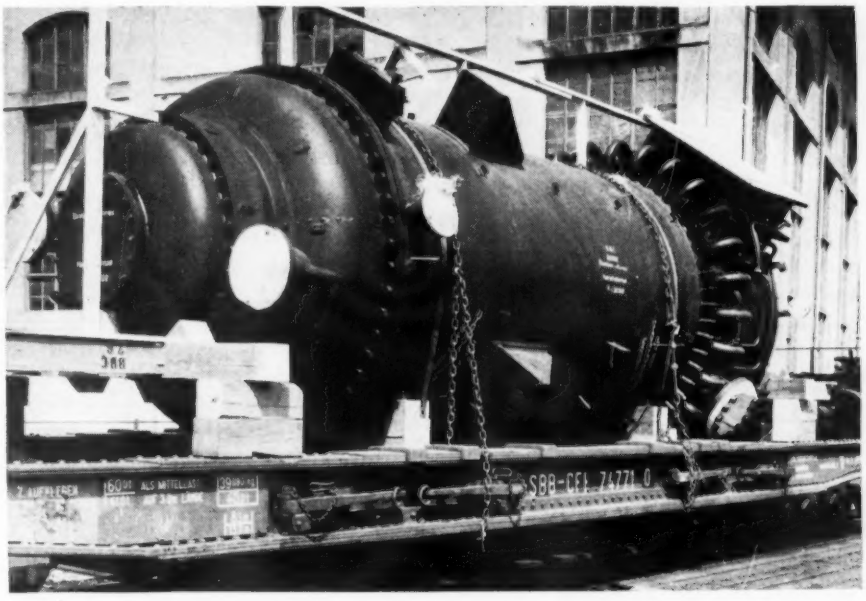


Fig. 4—Combustion chamber for a 200,000-lb-per-hr Velox unit on its way to the purchaser, after having been erected and tested in the shop

In several Velox plants, gas turbines have yielded excess power under favorable conditions such as low intake-air temperature, high compression efficiencies, etc. In these cases the gas temperature before the turbine ran well below 900 F. If these temperatures are increased to values quite permissible today (1050 F, for example), enough excess power can be made under all conditions to cover the auxiliary requirements of the entire steam plant. This supplementary output may amount to 2.5 to 3% of plant output. Generating power for auxiliary drives requires more than three times as much heat input when handled by the main generator instead of the gas turbine, so that 2.5-3% supplementary output means a gain in plant efficiency of 8-10%.

# Why Allow Water In Compressed Air?

***Water in compressed air slows production and increases the need for repairs on tools and interconnected equipment. C W Gibbs, Ingersoll-Rand Co, tells in readily understandable terms the reasons for this moisture in the air and how to accomplish removal by cooling and draining***

▶ WATER IN COMPRESSED AIR destroys lubrication in tools, makes them operate sluggishly (thus reducing output), and causes water hammer in air lines. Lines may freeze in winter, breaking pipe and fittings or restricting flow. Blowing the lines at the start of work to remove accumulated water wastes a tremendous amount of air as well as wasting the operator's time.

Modern plants use much compressed air, and it is significant that new plants make careful provision for removing this entrained moisture before the air enters distribution lines and tools. However, there are many existing plants, now called upon for maximum production, that are not so equipped. These plants would benefit by greater production and better tool operation resulting from moisture removal.

All free or atmospheric air, taken into a compressor, contains more or less moisture in the form of water vapor. No such thing as *dry* air exists in nature. When described as *dry* it usually means *relatively dry*. Upon this ability of air to carry moisture depends the conveyance and distribution of water over the earth's surface.

The following illustrates the principles involved:

(1) The ability of air to carry moisture depends on its temperature and volume and not materially upon its pressure. (Very recent data indicate that the higher the presure, the greater the moisture-carrying capacity of gases. For the purposes of this article this characteristic will not be considered.)

(2) The higher the air temperature, the greater the amount of water vapor which can be carried.

(3) There is a limit to the amount of moisture which can be carried by a given volume of air at any given temperature. When this limit is reached the air is said to be saturated or to have 100% relative humidity.

(4) Less than 100% relative humidity exists when the air contains less than the maximum vapor it could carry at its temperature. For example, cooling a given volume of air at 65% relative humidity reduces its capacity to carry moisture, and if sufficiently cooled it reaches saturation or 100% relative humidity. The temperature producing 100% relative humidity is known as the *dew point* because moisture starts to condense with any further cooling. Fog and dew are atmospheric moisture cooled below the dew point and condensed on dust particles or vegetation. Conversely, heating air at 100% relative humidity lowers its relative humidity and makes it capable of carrying more vapor. This is true even though the weight of vapor in a given volume of air remains constant.

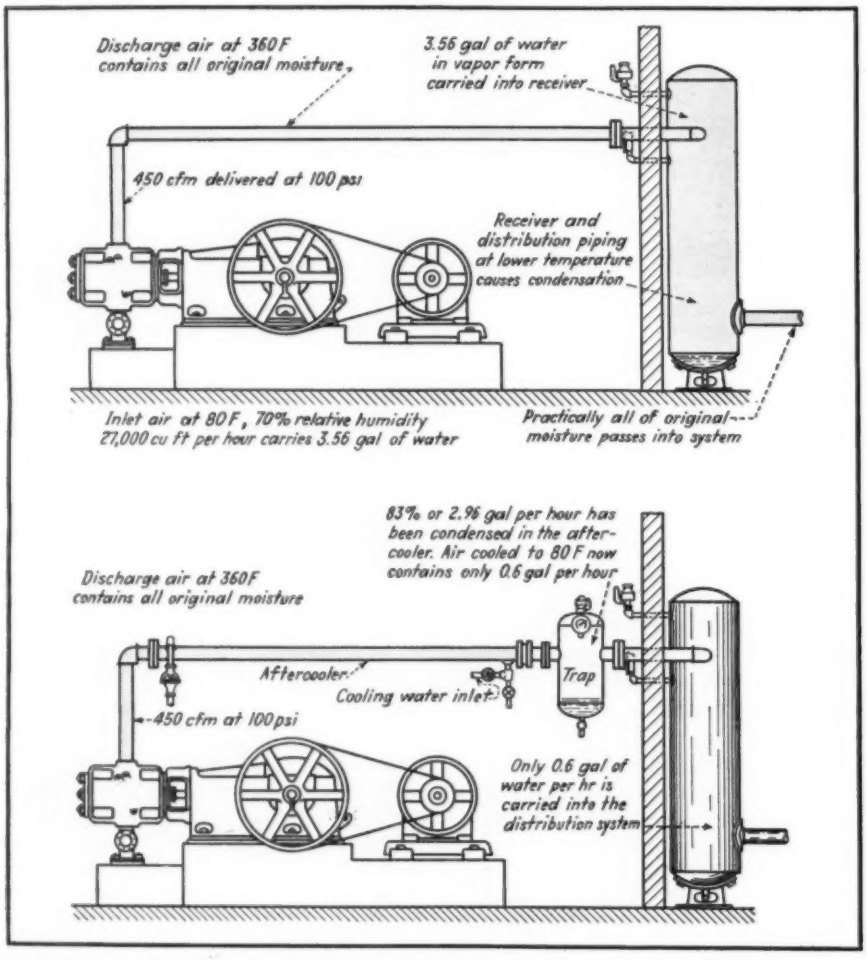

Discharge air at 360 F contains all original moisture
3.56 gal of water in vapor form carried into receiver
450 cfm delivered at 100 psi
Receiver and distribution piping at lower temperature causes condensation
Inlet air at 80 F, 70% relative humidity 27,000 cu ft per hour carries 3.56 gal of water
Practically all of original moisture passes into system
83% or 2.96 gal per hour has been condensed in the aftercooler. Air cooled to 80 F now contains only 0.6 gal per hour
Discharge air at 360 F contains all original moisture
Aftercooler
Cooling water inlet
Trap
450 cfm at 100 psi
Only 0.6 gal of water per hr is carried into the distribution system

**Fig. 1—(Top) Lack of coolers allows heated air and vapor to flow into receiver and piping. Atmospheric cooling condenses the vapor. (Bottom) Adequate coolers lower air temperature and condense 83% of vapor before air enters the receiver and system**

### *Locate Intake With Care*

If these statements are kept in mind there will be no difficulty visualizing conditions in a compressed-air system. Air compressors must take the air as it is found at the entrance to the intake pipe. Therefore, locating the intake so that air will come to the compressor as cool and as dry as possible becomes important. It is obvious that atmospheric air is the only source of water in a compressed air system operated correctly. Colder air entering the compressor intake will ordinarily carry less moisture. Obviously the intake should not be near a steam exhaust head. Take the air from outdoors and from a point where rain and snow cannot enter the compressor intake system.

Clearly, all moisture in a correctly operated system comes from the atmosphere; the next step is to see what occurs in the compressor. So far, it has been assumed that the volume of air involved did not change. In the compressor cylinder, however, the volume is reduced. In this respect a further statement applies:

(5) The amount of moisture that air can hold at a given temperature varies in proportion to its volume.

### *Effects of Compression*

Therefore, compressing 100 cu ft of air to 50 cu ft with no change in temperature cuts its moisture-carrying capacity in half. Or, if the original 100 cu ft was at 50% humidity, the final humidity will increase to 100%. It happens, however, that during compression air temperature rises rapidly. With each 20-F rise the capacity for holding moisture almost doubles. Under normal conditions there will be little condensation in the compressor cylinder; the moisture in vapor form will be carried along with the air.

For the present assume single-stage compression with the air going into the system carrying all its original moisture. If the compressed air could be used hot, as it comes from the compressor, there would be practically no water troubles. In actual practice cooling takes place in the air receiver and pipelines and, in accordance with the principles previously stated, the moisture condenses as soon as the air reaches the dew point.

Since a pressure of 100 psi involves 7.8 compressions (at sea level) or a final volume of only 13.5% of the original, it is evident that, if the air cools to the compressor intake temperature, condensation will take place with any original relative humidity greater than 13.5%. An average relative humidity is close to 70%, considerably above 13.5%, so the reasons for water in compressed air are clear.

The upper half of Fig. 1 shows graphically the water accumulation in the system by transforming the moisture to gallons per hour for a moderate-sized unit under average summer conditions. The lower half of the figure shows how adding an aftercooler eliminates the greater portion of moisture. An aftercooler is a heat exchanger that cools the air immediately after compression. Cooling must extend materially below the dew point to condense the moisture and allow the water to be separated from the compressed air before it enters the plant lines. An automatic condensate trap provides a positive method of removal.

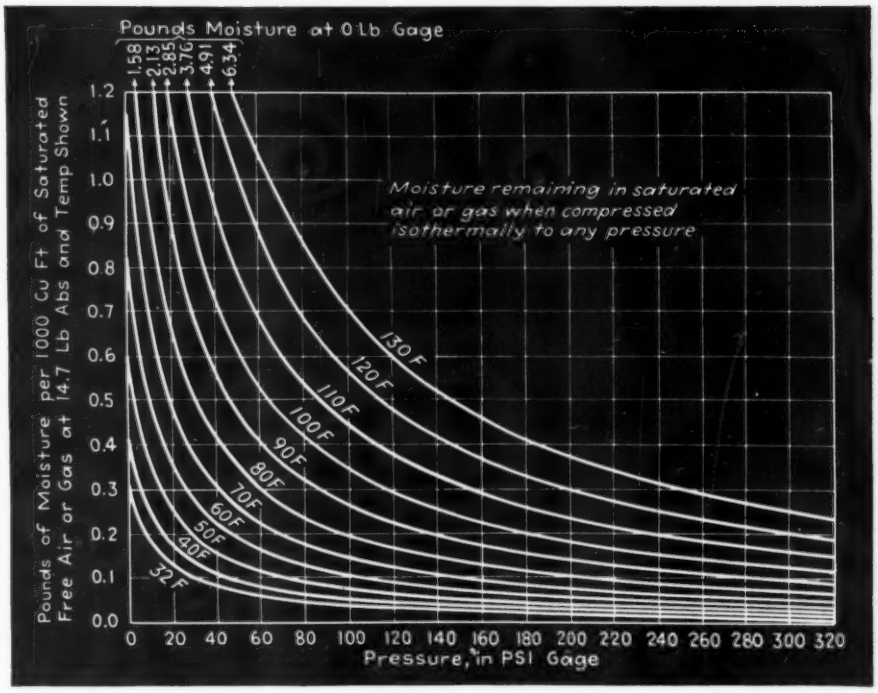



**Fig. 2—Values shown at top of temperature curves indicate intersection point with the zero pressure line at left. Moisture-carrying capacity increases with temperature**

In 2-stage compression the air is cooled between stages, principally because of the power saving thus obtained, but the moisture removal feature of intercooling should not be overlooked. A well-designed intercooler removes considerable moisture even though it operates at an intermediate compression stage under low pressures.

The operation of these coolers can be explained by referring to the curves of Fig. 2. Each curve represents the pounds of water vapor in 1000 cu ft of free volume at a given temperature before and after being compressed to various pressures. (This set of curves, although not theoretically accurate under certain conditions, gives results

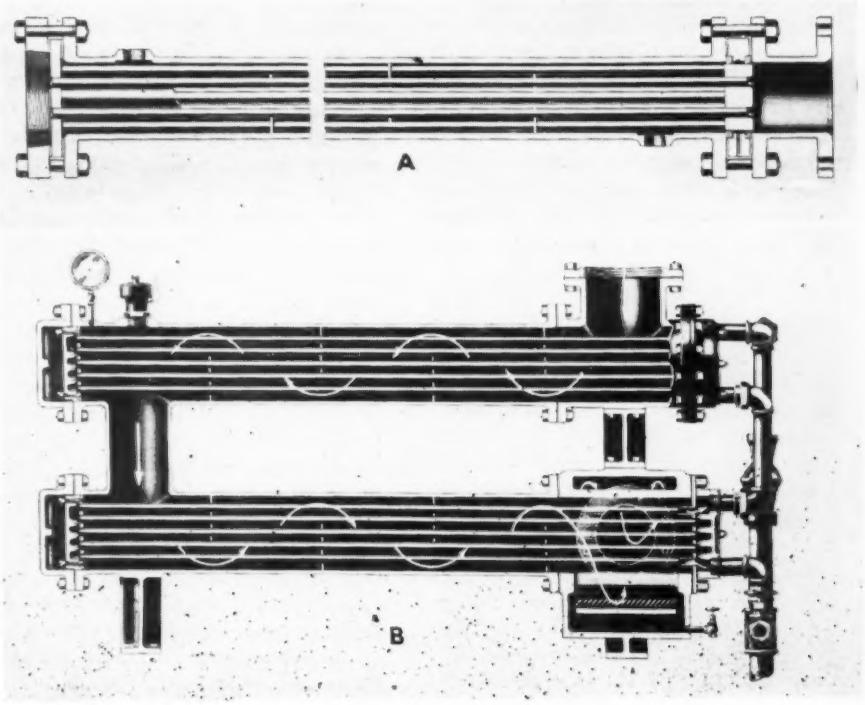



**Fig. 3—Internal construction assures maximum heat transfer from turbulence set up by baffles. Turbulent water flow produces intimate contact with inside tube surfaces**

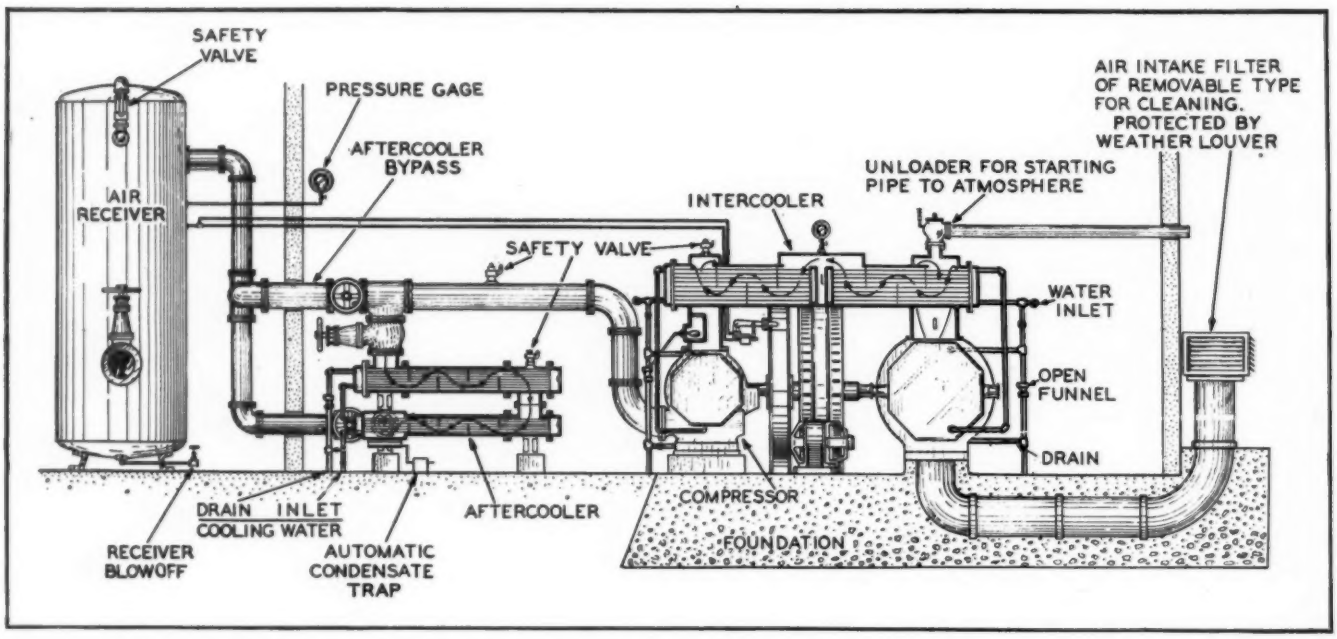



**Fig. 4—Weather protection on intake prevents entrance of snow and rain; intercooler condenses moisture and cools air for h-p cylinder; aftercooler cools discharge air and condenses additional moisture. Automatic traps discharge the water**

sufficiently correct for practical purposes.) Zero gage pressure means atmospheric or compresor intake condition. The curves either intersect the vertical zero-pressure line at the left or have the intersection-point value marked at their upper end. Each curve shows the quantity of water vapor in 1000 cu ft of mixture (as it comes to the compressor) at 100% relative humidity or saturation.

Assume a compressor intake of 80 F with 70% relative humidity. From the curve for 80 F and 100% humidity the water would be 1.58 lb per 1000 cu ft. Then 70% of 1.58 = 1.106 lb per 1000 cu ft. The intercooler pressure on a 2-stage unit will be about 28 psi with an assumed outlet temperature of 85 F. The air is of course saturated at the intercooler outlet. At this condition the curves indicate a water content of only 0.62 lb per 1000 cu ft. The difference, 0.486 lb, has been condensed in the intercooler.

After compression in the second stage to 100 psi the air containing 0.62 lb per 1000 cu ft cooled in an aftercooler to 80 F can hold only 0.19 lb per 1000 cu ft. Condensate amounts to 0.43 lb per 1000 cu ft. Therefore, in a 2-stage 100-psi compressor under the assumed conditions, the intercooler removes about 44% of the initial vapor content and the aftercooler removes an additional 39%. Only about 17% of the original moisture can be carried into the air lines. On a single-stage compressor the aftercooler would condense the total 83%.

Condensing the moisture and separating it from the air solves only part of the problem. The condensate must be removed from the system. An automatic trap on each cooler is essential for this. In addition, the receiver should be drained by hand at least once a shift. Traps are not usually installed on receivers. Every effort must be made to prevent the condensate going beyond the receiver.

Good moisture removal requires that the air be cooled close to the temperature of the available water and this means that the coolers must be correctly designed. Necessary design features include (1) maximum turbulence, to give the air and water intimate contact with the tubes, and (2) counter-current flow of cooling water and air. On the shell side, turbulence is obtained by using baffles and orifices, the latter preventing dead spots. On the tube side, velocities must be maintained above the critical value to insure turbulent flow with maximum heat transfer.

### *Counter-Current Flow*

Counter-current flow is obtained by parallel circuits in one shell as in the small cooler illustrated in *A* Fig. 3, or by using two shells in series, as in *B* Fig. 3. Each shell in the latter case has multiple water passes to keep the velocity above the critical. The basic circuit is, however, counter-current. For both intercoolers and aftercoolers, using the coldest available water is more economical and produces the greatest moisture condensation.

In spite of the fact that water is a natural associate of air as it comes to the compressor, proper compressor plant equipment, Fig. 4, eliminates a high percentage before it reaches the distribution lines.

However, some compressed air applications require more complete moisture removal. Such uses as enamel spraying (where a drop of oil or water will cause an imperfection) transfer of milk or other liquids by air displacement, and instrument control are among those needing particular attention.

Difficulty in these restricted installations is most apt to occur when the atmospheric temperature remains below the temperature of available cooling water or when the piping is located outdoors and exposed to low temperatures. The solution involves installing a separator or filtering device as close as possible to the point of air use.

Proper arrangement of piping will do much to reduce the load on the separator. Slope the pipe in the direction of air flow and provide drop legs or pockets to collect condensate at low spots and at the bottom of risers. A small tank forms the best collector and if possible should be piped so that the air enters about half way down and leaves at the highest point.

Typical designs of separators or filters use a porous stone, felt in a number of forms, or arrangements of baffles or spirals to remove the water. Although all types give good service the writer prefers the felt designs because the inserts may be dry cleaned and, as usually built, use baffles preceding the felt. Any of the more efficient filters require a certain amount of servicing.

# Make Deaerating Heaters Suit Plant Cycle—III

***Pointers on installing and operating direct-contact heaters with steam supply from variable-pressure source. Warren P Spining, Worthington Pump & Machinery Corp, details preferred hookups and methods of water storage in closed or open surge tanks***

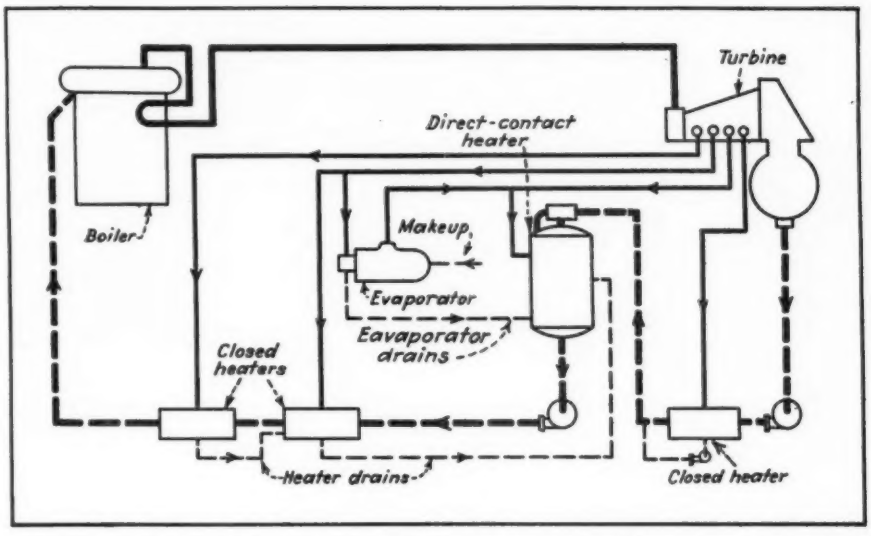



**Fig. 1—A typical variable-pressure direct-contact heater installation in a 4-stage-bleed condensing plant with evaporated makeup piped directly to heater compartment**

► DIRECT-CONTACT HEATERS can be operated satisfactorily under variable-pressure conditions provided the variations are relatively gradual. This is a normal condition in central stations and larger industrial plants that use condensing turbines in a heat-balance arrangement such as Fig. 1.

In such installations steam for the direct-contact heater comes from a "hole-in-case" extraction point at varying pressure. Extraction pressure absolute will vary in approximate proportion to turbine load as will water flow through the heater. In most large plants load changes occur gradually and do not impair deaeration. If load changes are sudden, however, uncontrolled extraction steam should not be used in the direct-contact heater.

### *Limit Heater Pressure*

Practical considerations dictate choice of bleed-steam pressure between 2 and 52 psi gage. If pressure falls below 2 psi gage the heater must be equipped with vacuum overflow controls and must be vented to a steam-jet ejector or to the main condenser. If pressure will exceed 52 psi gage initial cost of heater is appreciably increased by requirements of the Unfired Pressure Vessels Code.

If part-time operation at pressures below 2 psi gage is necessary, the heater should be equipped with some form of automatic control for cutting in the ejector, as in Fig. 2. When operating at pressures above 2 psi gage, the air-vapor mixture passes through the orifice, ejector and after-condenser to atmosphere. When heater pressure drops below 2 psi gage, automatic control valves admit steam to the ejector and bypass the orifice. The ejector can be omitted if the heater is vented to the main condenser.

Another way of providing for low-load conditions that would otherwise involve vacuum operation of the direct-contact heater is to peg the heater at a positive pressure of 2 psi gage or higher by a pressure-reducing valve taking steam from the next higher bleed point. When load conditions cause heater pressure to fall below a predetermined limit, the reducing valve admits steam from the higher bleed point. The lower bleed point is closed off by a non-return valve. While this arrangement yields slightly lower over-all plant efficiency, the loss occurs only at low loads and is usually of inconsequential magnitude.

The determination of amount of water storage to be incorporated in the heater requires careful study of plant conditions. For the system of Fig. 1, the most important function of water storage is to provide an emergency supply for boilers in event of failure of normal flow of condensate. The amount necessary will depend on reliability of emergency sources and time needed to cut them in. In addition, storage in the heater takes up variations in water volume caused by load changes and makes up for losses during periods when evaporators or water-treatment systems are shut down.

### *Additional Storage Needed*

It seldom proves practical to incorporate all water storage in the heater itself because the tank would be excessively large. It is customary to limit heater storage volume to 2–10-min flow at full load and store additional water, if required, in a separate tank.

Several methods of providing additional storage are available. Fig. 3 shows an open tank above the heater from which all condensate flows by gravity to the heater. Fig. 4 illustrates an open storage tank that floats on the line ahead of the heater regulating valve to accommodate surges.

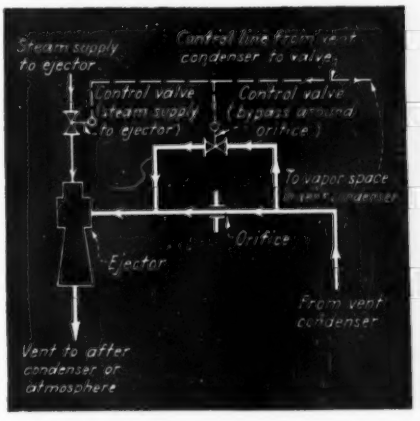

Steam supply to ejector
Control line from vent condenser to valve
Control valve (steam supply to ejector)
Control valve (Bypass around orifice)
To vapor space
Orifice
Ejector
From vent condenser
Vent to after condenser or atmosphere

**Fig. 2—Control for automatically cutting in air ejector at pressures below 2 psi gage. Note bypass around orifice**

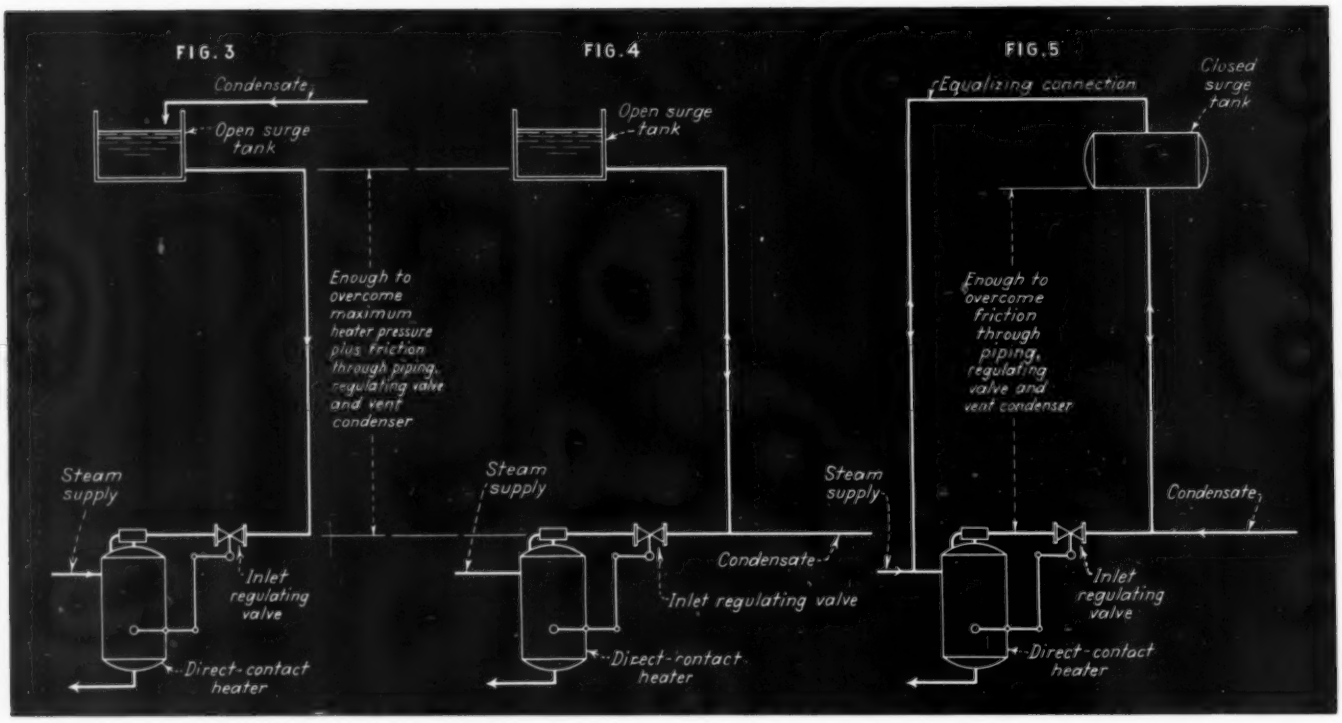



**Fig. 3—Extra storage in open tank above heater must be elevated enough to overcome maximum pressure plus friction through piping, regulating valve and vent condenser. Fig. 4—A variation of Fig. 3 in which the pipe to the overhead tank handles only excess or deficiency of condensate flow. Fig. 5—Closed overhead tank requires only sufficient head to overcome friction through piping, regulating valve and vent condenser but must be built as a pressure vessel**

Disadvantage of these arrangements lies in the need for elevation sufficient to overcome maximum steam pressure in the heater as well as pipe friction, regulating-valve drop and friction loss in the vent condenser. In addition, open storage of water permits absorption of oxygen which imposes an extra burden of daeration on the heater. Also the regulating valve for these systems must be large enough to pass maximum water flow with minimum level in the overhead tank and must be able to regulate down to minimum capacity with maximum level in the tank and minimum pressure in the heater, a difficult requirement.

### *Closed Pressure Tank*

By using a closed storage tank above the heater as shown in Fig. 5, the elevation of the storage tank can be materially lessened. Since steam pressure is equalized, the elevation need be only enough to overcome pipe friction, vent-condenser friction and pressure drop across the regulating valve. Oxygen contamination of stored water is avoided. The water regulating valve still must handle the entire flow but the pressure drop across it will be reasonably constant at all loads. The chief disadvantage of closed overhead storage lies in the cost of the tank itself which must be built to stand full heater pressure.

Fig. 7 shows how an open storage tank at any convenient elevation can be used. Main condensate flow passes uncontrolled to the heater without need for a large regulating valve. If condensate flow exceeds demand, water level rises in the heater storage compartment and a high-level float causes a small valve to bypass part of the condensate to the open tank. If condensate flow is insufficient, a low-level float opens the make-up valve between storage tank and condenser. Condenser vacuum will cause flow without a transfer pump even if the storage tank is at hotwell level.

Bypass and makeup valves, usually located some distance from their respective floats, should be pneumatically or hydraulically operated and capable of good flow regulation. The bypass valve should be sized to handle maximum excess condensate that could exist under normal changing load conditions and the makeup valve should match maximum net deficiency in boiler-feed requirements, both usually less than 10% of main condensate flow.

As an emergency provision, overflow from the heater is piped to the storage tank in event the bypass valve is inadequate for unusual conditions. An emergency transfer pump, controlled by a low-level float switch on the heater, returns stored water to the heater should the normal makeup arrangement fail or become inadequate. While start and stop operation is not recommended for normal water supply to a direct-contact heater, it is quite satisfactory for such emergency service.

In Fig. 7, ejector inter- and after-condensers and stage heaters have been omitted for simplicity. The bypass line should be connected to the condensate system at a point between the after-condenser and the first-stage heater so that bypassing condensate to the storage tank will not reduce the flow through the ejector cooling system nor waste heat absorbed in the first heater.

While the water in the storage tank is exposed to air and can therefore absorb oxygen, the main condensate flow is not so exposed. The makeup return from the open tank, normally a relatively small quantity, flows to the main condenser where it is partially deaerated before it passes to the direct-contact heater.

### *Simple Control System*

Another arrangement, Fig. 6, stores condensate in a closed low-level tank. This system requires no valves other than an overflow control from the storage tank to waste. Condensate flows uncontrolled to the heater. Any excess over the capacity of the heater storage overflows by gravity to the closed tank.

An equalizing connection between the steam spaces of heater and tank holds the tank space at heater pressure, eliminating need for an overflow valve on

the heater. Admitting steam to the tank prevents stored water from absorbing oxygen, helps keep storage heated and reduces the power required by the transfer pump in returning water to the boiler-feed system.

The transfer pump, controlled by float switches in the heater, returns condensate that has already been deaerated. Its temperature is only slightly below that of the direct-contact heater. Admission of this water under start-stop control does not adversely affect heater operation. It is good policy, however, to size the transfer pump for normal requirements and provide a second pump for emergencies.

This system provides a relatively large amount of heated and deaerated water for immediate use. However, the tank must be a pressure vessel designed for heater pressure, transfer pumps involve appreciable cost and water is stored at about heater temperature which involves some radiation loss.

### *For Low Makeup Only*

In all the systems described here makeup is assumed to be only a small percentage of normal condensate flow. Demand for makeup in large generating plants usually remains fairly constant and is derived from evaporators under manual control. Operators start, stop or regulate evaporators in accordance with demands of the system as indicated by water level in the storage tank, or in the heater if no separate storage is provided. Unless the makeup is deaerated ahead of the evaporator, the resulting vapor or condensate may contain oxygen and should be added to the system ahead of the direct-contact heater.

A common evaporator arrangement, Fig. 1, provides for introducing vapor

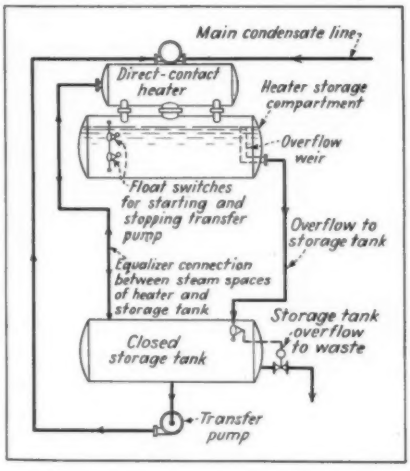

Main condensate line
Direct-contact heater
Heater storage compartment
Overflow weir
Float switches for starting and stopping transfer pump
Overflow to storage tank
Equalizer connection between steam spaces of heater and storage tank
Storage tank overflow to waste
Closed storage tank
Transfer pump

**Fig. 6—Closed storage tank below direct-contact-heater level requires only float switch for starting transfer pump and float control of overflow to waste**

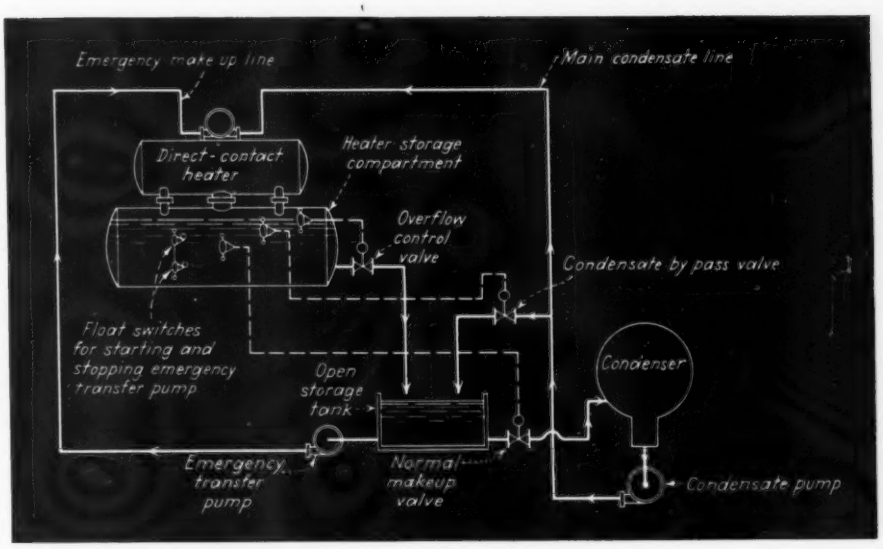



**Fig. 7—Main flow of condensate uncontrolled. Small valves bypass excess condensate or admit makeup. Storage tank at condenser level has emergency transfer pump**

directly to the direct-contact heater without a separate evaporator condenser. With this system, the evaporator must operate at the same pressure as the direct-contact heater and steam for the evaporator coils must be obtained from a higher pressure bleed point.

### *Collection of Drains*

Another useful function of the direct-contact heater, if proper provision is made in its construction, can be the collection of various drips and drains from steam lines, stage heaters and other sources. Special openings and distribution pipes required in the heater to handle these drains should be designed for the particular quantity, temperature and pressure of each. It is important that full information on the character of drains be available to the manufacturer designing the heater.

No discussion of direct-contact heaters operating at variable pressures would be complete without consideration of the effect of sudden pressure changes. Even if normal conditions are ideal, unusual or emergency conditions may result in a sudden change in heater pressure. Increased pressure may adversely affect deaeration during the short period while the change is taking place, but otherwise should cause no serious trouble. A sudden decrease, on the other hand, causes severe flashing of the heated water in the storage compartment (and also in the overflow tank of Fig. 6).

The worst case would occur if a fully loaded turbine suddenly cut off the line. Pressure at the bleed point would fall almost instantly to condenser vacuum. Were heater pressure to fall at this rate, stored water would flash into steam with almost explosive violence and the flashing would extend down through the suction piping to the boiler-feed pumps. However, if the non-return valve in the extraction line is functioning properly, such a sudden pressure drop can never occur in the heater. As the heater pressure starts to drop, stored water flashes into steam, greatly reducing the actual rate of pressure drop. The resultant rate depends on amount of water entering, initial steam pressure, amount of stored water and rate of water withdrawal. From 10 to 40 minutes may elapse before heater pressure falls below atmospheric.

The heater may rumble during this period but, if properly designed, should need no special attention. Likewise, if the boiler-feed pumps have sufficient net positive suction head and are properly piped up and vented according to manufacturer's recommendations, they should not vapor bind during such periods.

Deaeration takes place in a direct-contact heater when steam and water are brought together in close contact. If the designer remembers that deaeration will occur at any pressure, providing the water is brought to saturation temperature for that pressure, the direct-contact heater can be made to suit any set of plant conditions.

Many other arrangements for operation of direct-contact heaters under variable-pressure conditions are both possible and practical. Requirements of a particular plant or layout often dictate combinations of or modifications to the basic systems here described. These fundamentals, if kept in mind during the initial stages of plant design, will help avoid errors in direct-contact heater application.

# The Old Chief

## 25—Conventions

***Another in the series by William Doran, chief engineer, Essex County Sanatorium, Windsor, Ontario. Writing of the past, he has captured much of the human side of engineering behind the many wavy lines on paper disks***

▶ ABOUT THE FIRST ORGANIZED GABFEST I ever attended was on that never-to-be-forgotten occasion when the big Engineers Convention came to our town. For weeks and weeks the Old Chief was "up to his neck" in the arrangements for the event. There was the Boat Ride, the Picnic and the "Eucre and Dance" in honor of the ladies that was to wind up the festivities. The Old Chief himself was slated to describe the Zeuner system of valve diagram. I remember scouring the local schools for the largest blackboard I could borrow. I also helped him to make a very large working model of an engine out of cardboard and plywood. The model worked fine except that the eccentric would persist in falling off at awkward moments.

As I was working on the day shift, my contact with the convention was confined to the evenings; I missed a splendid address by the retiring president on "The Enactment, Enforcement and Unification of Engineering Laws." I also missed a number of very educational lectures, sponsored by the trade houses.

### *The Confusion Starts*

On the first evening I was assisting at the registrating table at the hotel; we were not long in discovering that as the newly arrived delegates were recognized, and the hand shaking and back slapping started, we could not get anywhere with these jovial old fellows. So we moved our table right up to the door, where we could catch them first hand. At that time I prided myself that I could spot an engineer on sight by "the cut of his jib."

The majority of the delegates had *engineer* written all over them; square jawed, big shouldered, big hands and big cigars. I gathered from the way they dodged committee assignments that the business of the convention was secondary to meeting kindred souls and renewing old acquaintances.

There is a certain air of genial confusion about a convention. There is no such thing as privacy or a sanctuary to be found anywhere in the hotel. Groups meet, merge and separate, conversations start abruptly and end abruptly. I saw one poor committee vainly trying to whittle about thirty resolutions down to a presentable six; for the business session of the following day. Delegates would come barging in and out of the room in a constant stream.

Some were new arrivals who had to say "Hello" to Joe. Others were boosting their town for next year's convention, others again would bring messages and sometimes commands from their better halves, but what finally made the committee decide to adjourn until early the following morning was a crowd in the hall just outside who harmonized "Annie Laurie," "Old Black Joe," and twenty verses of "Old MacDonald Had a Farm."

On the following afternoon and evening I met many engineers and salesmen for the first time, whose friendship is to this very day a thing of privilege and rare value to me.

As I mixed with the crowd milling around the hotel, I noticed that every time the Old Chief spotted me, he introduced me to some man that he assured me he very much wanted me to meet. I suspected my worthy Chief of having ulterior motives, because they were all people with "fixations." One of them was a uniflow engine man and no matter how skilfully I changed the subject of conversation, in two minutes I was back discussing uniflow engines. Another of the boys I "just had to meet" was air-compressor conscious. I soon gave up the struggle and submitted to being metaphorically drawn through Aftercoolers for about an hour. Then there were marine men with whom you might start off discussing the drought in the Middle West. Suddenly the wind would freshen and you would find yourself "Down to the sea in ships."

As to the value of that convention to our calling, there was of course the educational value and perhaps it added fuel to the then pressing demand for boiler codes and standards. It also may have impressed some politicians with the voting power of engineers. Two things I know it did for me. First, it allowed me to meet a lot of grand engineers who, secure in the knowledge of their capability, resourcefulness and skill, were proud of their membership and their calling. Second, it made me a convention addict for the rest of my days.

# Good Maintenance Keeps Transformer on the Job

By M H BATES
*Power Transformer Eng Dept*
*General Electric Co*

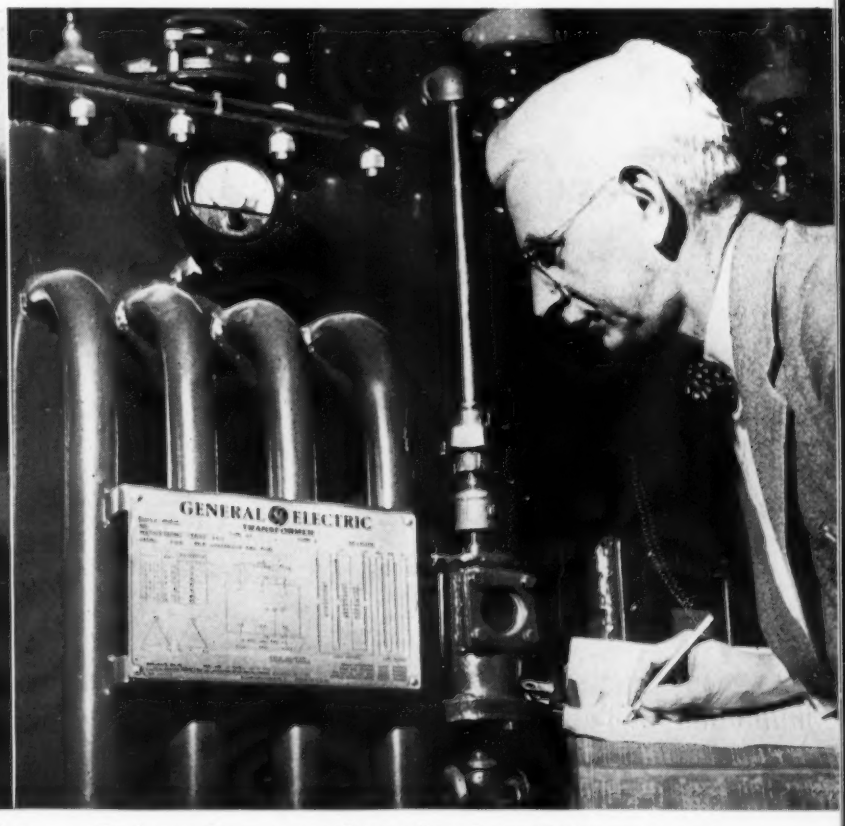
***Here are a few simple maintenance rules that insure maximum output from this equipment to meet emergency power loads***

▶ ATTENTION GIVEN TRANSFORMERS during their first few months in service does much to insure long life and successful operation. This may be a jolt to many operators who believe that a transformer, a static piece of equipment, can be installed and forgotten.

(CONTINUED ON PAGE 98)

Sample oil in a 1-pint, clean, dry, clear-glass bottle. As a good preliminary precaution, wipe the valve clean and run off some oil to clean out condensate and dirt before taking sample

On small transformers, look inside the tank to make sure that oil stands at the correct 25-C level marked on the inside




Check transformer nameplate and read specific instructions to which it refers before installing the equipment

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## *"The Daddy of all Underfeed Stokers"*

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As manufacturers of practically all types of coal burning equipment, the Riley Stoker Corporation is in a position to be of service to you if you find it desirable or necessary to change from oil to coal firing. Our engineers will gladly be of maximum service to you in helping to solve this problem, whenever you call upon them.

If your boilers are rated from 40 H.P. to 600 H.P., probably you will find, as have hundreds of other companies, that your best answer to your oil to coal conversion problem is the installation of Riley-Jones Side Dump Stokers.

Riley-Jones Side Dump Stokers are adaptable to practically any boiler setting with but minor changes. Their installation does not require a basement for removal of ashes.

### Over 50 Years of Stoker Experience

The Riley-Jones Stoker is the daddy of all underfeed stokers—first manufactured in 1888. Constant improvement has kept it at the head of the list. Thousands of the country's leading companies use them. Be sure to take advantage of Riley's extensive stoker experience by consulting a Riley engineer. Riley-Jones Stokers are manufactured in sizes for application to boilers from 40 H.P. up and in varying widths and lengths to fit the requirements of each individual plant. They can be either hydraulically, mechanically or steam operated.

### Enlarged Manufacturing Facilities Assure Prompt Shipment

Because of enlarged manufacturing facilities, prompt shipment of Riley-Jones Side Dumping Stokers can be made on projects authorized by the War Production Board, in spite of the large number of companies who are selecting this equipment when converting from oil to coal firing. You are nevertheless cautioned to place your orders promptly to assure minimum inconvenience.

***A survey of your power plant by a consulting engineer will probably show ways of making surprisingly large savings in power costs.***

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Building—451 W. End Ave.
Building—150 Nassau St.
Building—1327 Lexington Ave.
McAlpin Hotel
Shelton Hotel
Pasadena Apartments
Bullard Company
Armour & Company
Manhattan Print Works
Worcester Art Museum
Danvers State Hospital
The Hamersley Manufacturing Co.
Ford Instrument Co.
Hart Manufacturing Co.
Kent Manufacturing Co.
Arkell Safety Bag Co.
Heyden Chemical Co.
Wrentham State Hospital
Draper Brothers
Savannah Sugar Refining Co.
Union & New Haven Trust Co.
Pathe Laboratories
Mass. Institute of Technology
Okonite Company
Publicker Comm. Alcohol Co.
Eastern Malleable Iron Co.
White Laundry
Blackstone Valley Gas & Elec. Co.
Hatfield Wire & Cable Co.
Rockwood Sprinkler Co.
The Bristol Company
The Celotex Corporation
Happiness Laundry
Lehn & Fink Products Corp.
Colt's Patent Fire Arms Co.
Forbes Lithograph
Moore Steam Turbine Co.
Manville-Jenckes Corp.
Scovill Manufacturing Co.
New Departure Division, General Motors Corp.
Paterson Laundry
Firestone Rubber & Latex Co.
The Centaur Co.
Breyer Ice Cream Co.
Conmar Products
Forsgate Farms
Hoffman Beverage Co.
Worcester City Hospital
Consolidated Cleaners & Dyers
General Fire Extinguisher Co.
Rheem Manufacturing Co.
Roxy Hotel
Heintz Manufacturing Co.
American Steel & Wire Co.
New Bedford Rayon Co.
E. R. Squibbs Sons
Perfect Laundries
U. S. Gypsum Co.
The Heil Co.
Holland Laundry
Southington Hardware Co.
Y.M.C.A., New York City
Fischer Baking Co.
Reynolds Metal Co.
Piel Brothers
Greist Manufacturing Co.
Adams Laundry
Thompson Wire Co.
Perkins Machine & Gear Co.
Bell Aircraft Co.
York Safe & Lock Co.
Pepsi-Cola Co.
Merck & Company

(CONTINUED FROM PAGE 95)

Keeping a close check during the first three months of operation will indicate whether the equipment has been properly installed, and if not, will reveal any existing or incipient troubles.

Do not install transformers in poorly ventilated rooms, exposed to dirt and fumes, near high-temperature furnaces, or in boiler rooms, if you expect them to give trouble-free operation.

Assume a typical transformer properly installed with all connections correctly made. Right here, even before energizing the transformer, three things should be done:

(1) Check the oil for proper level at 25 C (77 F). On small transformers this means seeing that oil level comes up to the mark inside the tank. Larger transformers have gages which indicate proper oil level at 25 C. Low oil level may cause poor circulation and the transformer may overheat. Too high an oil level may cause excessive gas pressure in sealed transformers, excessive loss of gas in gas seal transformers or the oil to overflow when the unit reaches full-load temperatures.

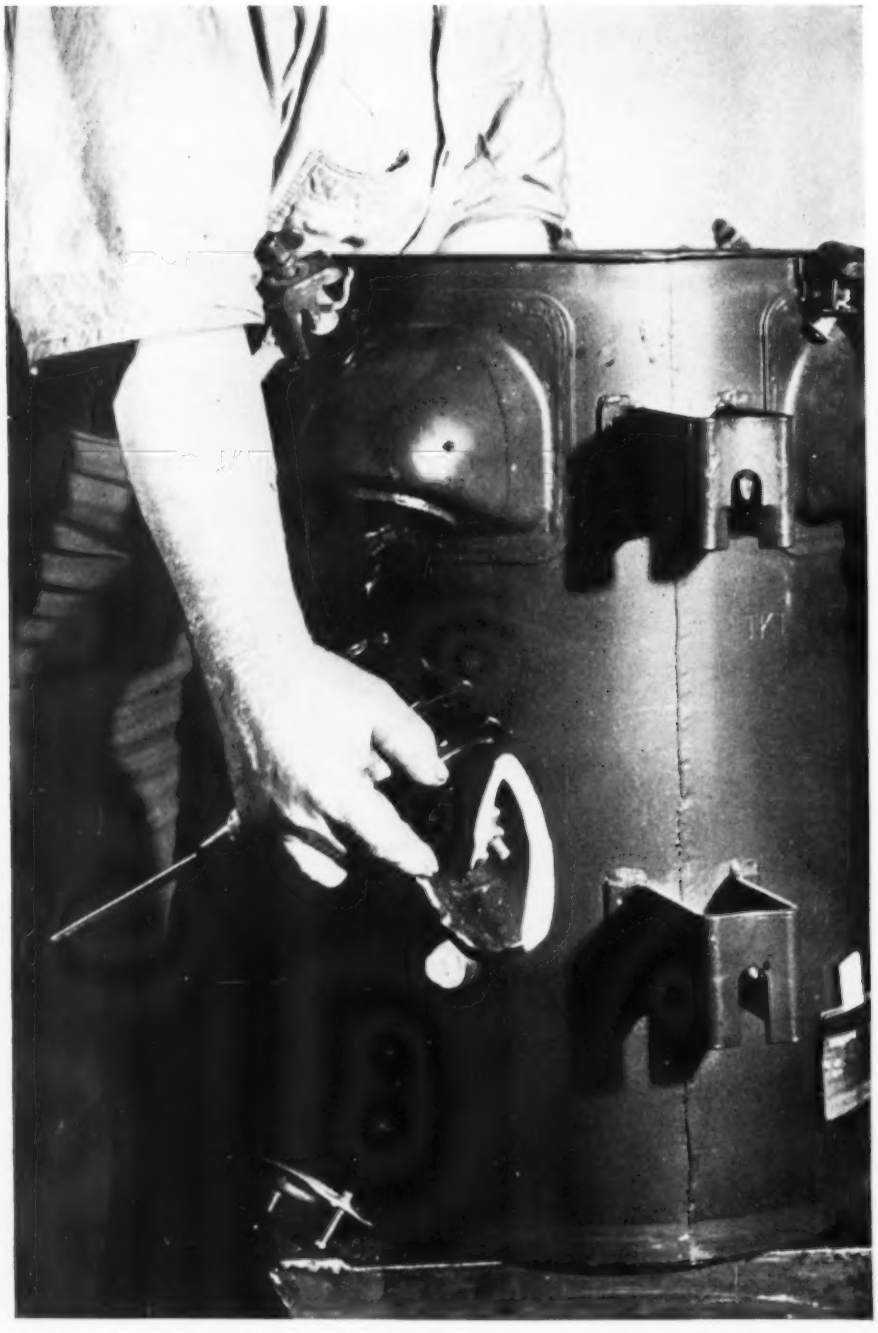
(2) Check ambient temperature. If the air surrounding the transformer exceeds 40 C (with 24-hour average of 30 C), full load should not be carried. Consult ASA Standards before loading the transformer.

(3) Check dielectric strength of the oil, taking samples from top and bottom of all transformer oil containers. Some specially designed transformers have as many as five separate compartments containing oil. Check the oil in each compartment. When shipped, transformer oil has a standard dielectric strength of at least 25 kv, when tested between 1-in. disks spaced 0.1 in. apart in standard oil-test receptacles.

Remember, a dielectric test will be worthless if the oil is not sampled properly. Here are the fundamental precautions for correct sampling:

1. Use one-quart, clear-glass bottles for sampling. If metal containers are used, be sure they are free from rust or solder.
2. Bottles must be thoroughly clean and dry. Rinse them with clean, dry oil and allow them to drain for a few minutes.
3. Before drawing a sample from the bottom of the tank, clean the valve and allow some oil to run off, as much as a quart for a large transformer to remove any condensate that may be in the valve. Take samples from askerel-filled transformer from the top through the small valve or plug provided for the purpose.
4. Stopper or cap the container, and seal it with paraffin or wax immediately after drawing the sample. Do not use rubber or composition of rubber for gaskets or stoppers. If the sample is sent away for testing, pack the bottles carefully to avoid breakage in shipment.

Make dielectric strength tests of oil samples each week for the first four



**Replace damaged porcelain bushings before they cause a short-circuit that will shut down the transformer or cause more serious damage to the power system or equipment**

**Drawing oil into containers like these reduces the possibilities of getting a true sample of oil. Never use rubber or composition rubber stoppers or gaskets. Proper oil sample containers can be obtained from the transformer manufacturer**

weeks that a transformer operates. Thereafter, make them once every three months for water-cooled transformers, and once every six months to a year for other types, depending on size and importance of the installation. Give water-cooled transformers a more frequent check because of greater possibility for water leaks inherent in their construction.

Pass oil that tests 20 kv or less through a filter press. Where filter-press equipment is not needed frequently enough to justify its purchase, the oil can be filtered at the manufacturer's service shop. Sometimes special arrangements can be made to obtain the equipment to do the filtering from the local utility company or the transformer manufacturer. In the filter press, the contaminated oil is forced through several layers of special filter paper which absorbs the moisture and catches any sediment. Proper filtering of oil in an efficient press will raise its dielectric strength to values between 25 and 30 kv. Immediately before using, dry the filter paper thoroughly according to manufacturer's instructions.

### *Check Oil Level*

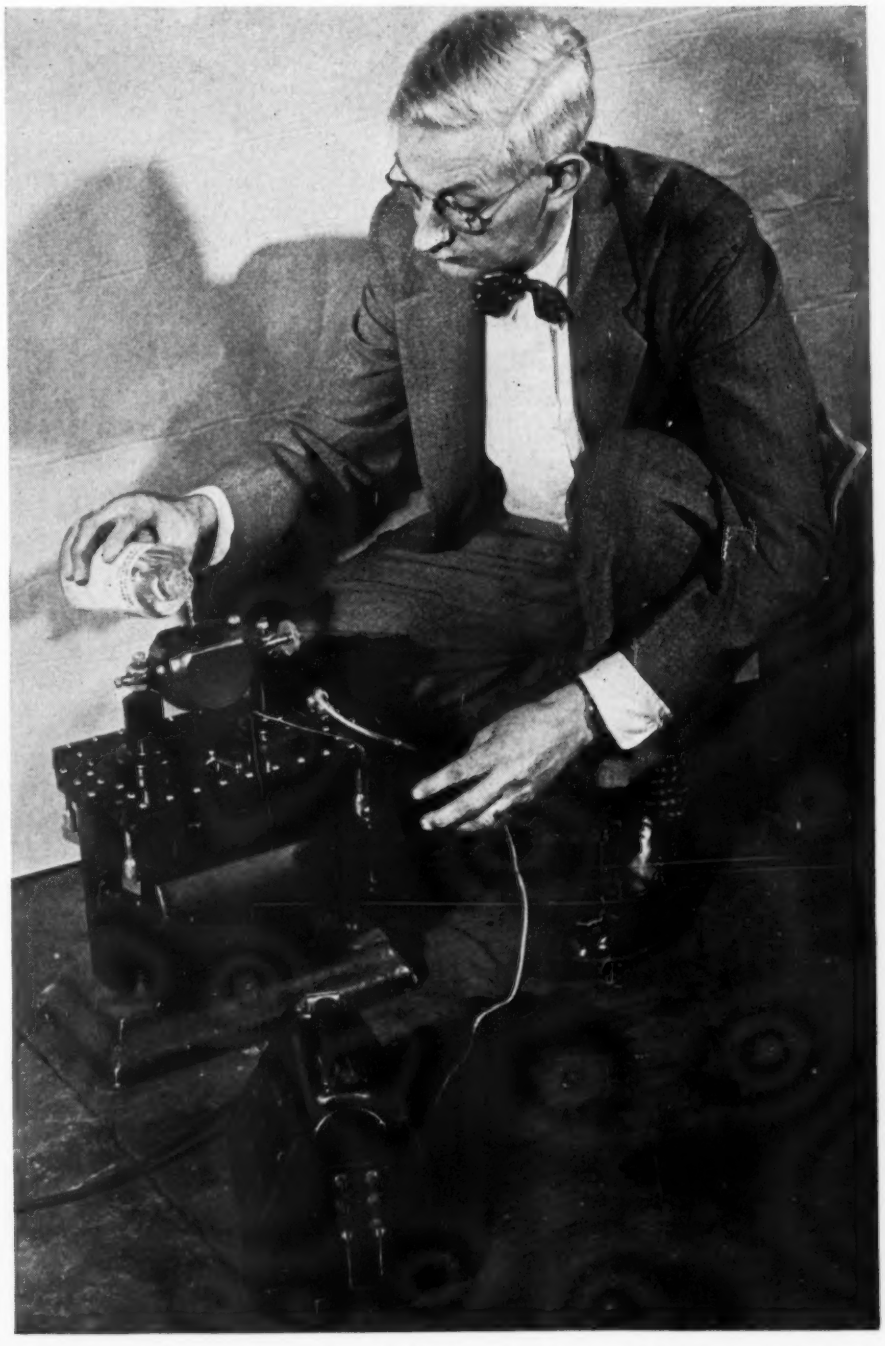
For the first three months of operation, frequently check the oil level in the transformer for evidence of loss of oil, if no gage is provided, ambient temperature and oil temperature. Any deviation from normal in these conditions probably indicates some trouble that can be easily rectified.

Check transformers equipped with a winding temperature indicator at least twice daily to be sure that hot-spot temperatures keep within safe limits. In an ordinary transformer, maximum coil temperature should not exceed 90 C. If it does, investigate the cause if the condition exists for more than permissible overload period. This also holds for the top oil temperature in the transformer, which should not exceed 85 C for more than the permissible period, as set forth in ASA Guide for Operation of Transformers, C-57.3.

In transformers which are not sealed, air breathing occurs above the oil level. Moisture may collect on the underside of the transformer covers. Three common causes for this condition are leaky gaskets, cracked or damaged porcelain bushings, and restricted breathing. To correct the first fault, install a new gasket; the second, repair or replace the bushing; the third, free the breathers of dirt or other obstructions. Remove the manhole or main cover of transformers of this type for inspection after a short initial period of operation and periodically thereafter. If moisture, corrosion or deposits of any kind are found, determine the causes and correct them at once.

Moisture can be removed from the windings, when the windings and core are immersed in oil, by *short-circuit* drying of the windings or by the so-called *normal-operation method* of drying. The short-circuit method is recommended. Complete details on methods of drying are contained in the manufacturer's instruction books and should be followed closely. Briefly, the *short-circuit method* consists of heating the windings and oil by short-circuiting one winding and applying a suitable

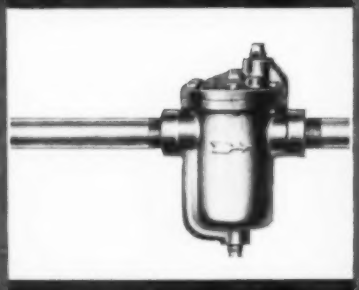
(CONTINUED ON PAGE 102)



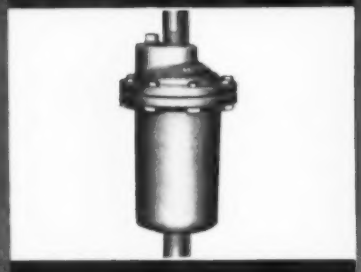
Handy portable testing sets are available for checking the dielectric strength of oil. Put oil that tests 20 kv or less through a filter press to restore it to proper condition

# STEAM is Precious

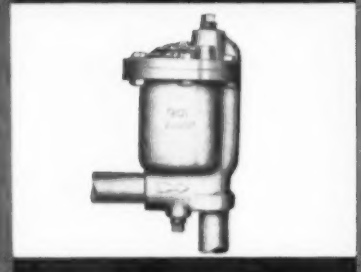
**For Neatest Possible Hook-ups and Minimum Piping**



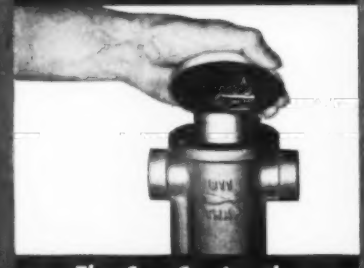
**Side Inlet -- Side Outlet**



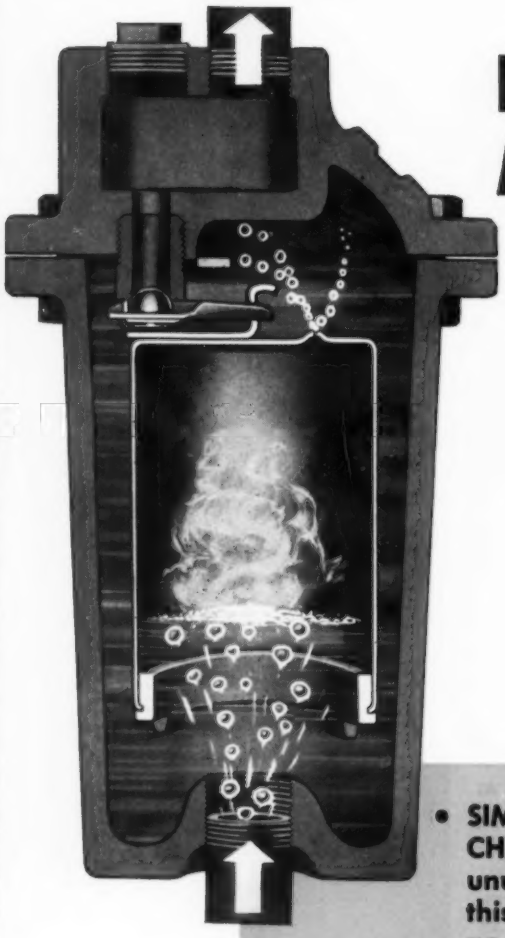
**Bottom Inlet -- Top Outlet**



**Side Inlet -- Bottom Outlet**



**The Cap Carries the Whole Works**



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- **SIMPLE, DEPENDABLE INTERIOR MECHANISM.** First developed to meet unusually severe service conditions, this construction is now standard at no extra cost.
- **HEAT TREATED VALVE AND SEAT.** The same quality and special alloy composition as used in Armstrong traps for 1500 lbs. pressure.
- **INDIVIDUALLY TESTED.** Even traps for lowest pressures have close grain, semi-steel bodies and are tested with a minimum hydraulic pressure of 500 lbs. per sq. in. Valves and seats are lapped together for maximum tightness.
- **ADVANCED DESIGN.** Free-floating valve, no fixed pivots to wear, no narrow clearances. Positive valve action—wide opening, tight closing. No steam leakage with light loads. Non air-binding . . . self-scrubbing . . . big capacity!

ARMSTRONG TRADE MARK "INVERTED BUCKET" STEAM TRAP

# Armstrong

# THESE DAYS...

## MAKE THE MOST OF IT WITH *Good* TRAPPING

### THE SCOREBOARD

| PENALTIES OF POOR TRAPPING | GAINS FROM GOOD TRAPPING |
|---|---|
| STEAM AND FUEL WASTE | The Midland Chemical Laboratories, Inc., Dubuque, Iowa, cut fuel oil consumption over 40,000 gal. per year by installing 16 Armstrong Traps and some new piping. |
| WASTE OF BOILER CAPACITY | The Bestovall Canning Co., Ltd., Vancouver, B. C., ordered a new 65 H. P. boiler, then found it wasn't needed when 7 Armstrong Traps were installed. |
| WASTE OF MANPOWER | R. Thomas & Sons Co., Lisbon, Ohio, saved 19 man days per month maintenance time after installing 50 Armstrong Traps. |
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IN terms of time, fuel, metal, manpower and money that goes into its production and utilization, steam for war production, becomes a precious commodity these days. Inefficient use of steam represents a serious drain on America's production capacity.

Armstrong Steam Traps are noted steam savers. They eliminate the steam leakage which is permitted by faulty drainage devices. As much as 835,000 lbs. of steam at 100 lbs. pressure can be lost through a ½" orifice in a month.

Armstrong Traps automatically eliminate air. One half of 1% by volume of air mixed with steam can cause a reduction in heat transfer efficiency of 50% according to one authority.

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For complete information on Armstrong Traps for your plant, write today. Ask for the Armstrong Steam Trap Book and the new Service Guide on trap maintenance.

**ARMSTRONG MACHINE WORKS**
**812 Maple Street • Three Rivers, Michigan**

# STEAM TRAPS

(CONTINUED FROM PAGE 97)

voltage to the other. Water vapor given off by the hot oil is carried away by ventilation and filtration.

The *normal-operation method* of drying the windings, applicable only to transformers that normally permit air breathing, is done mainly by forced or natural ventilation, and partially by oil filtration, with the transformer in operation. Although this method can be used without shutting down the transformer, use it only in dry weather or when the transformer cannot be taken from service for short-circuit drying.

Drying can be done with the windings and core not immersed in oil, and preferably, enclosed in a temporary housing. Clean, dry air at 85 C is forced into coils and insulation at the bottom of the transformer and allowed to escape at the top. This method is preferable for rectangular shell-type units because of their mass of insulation. Large quantities of air are required for thoroughly drying the winding and the oil must be dried by a filter press.

Drying can also be accomplished by removing the core and coil assembly from the tank and putting it in an oven. In the *natural-draft method* heated air circulates through the transformer by natural draft. Source of the heat may be resistance grids or a steam coil. A potential fire hazard exists in all types of hot-air drying if oil drips on the heat source or if the temperatures are not carefully controlled.

Usually, it is advisable to obtain recommendations regarding the drying of large transformers from the manufacturer. When making requests for this information mention the serial number of the transformer and give the voltage and kva capacity available for doing the drying; indicate also whether any step-up or step-down transformers are available to do the drying job.

### *Color of the Oil*

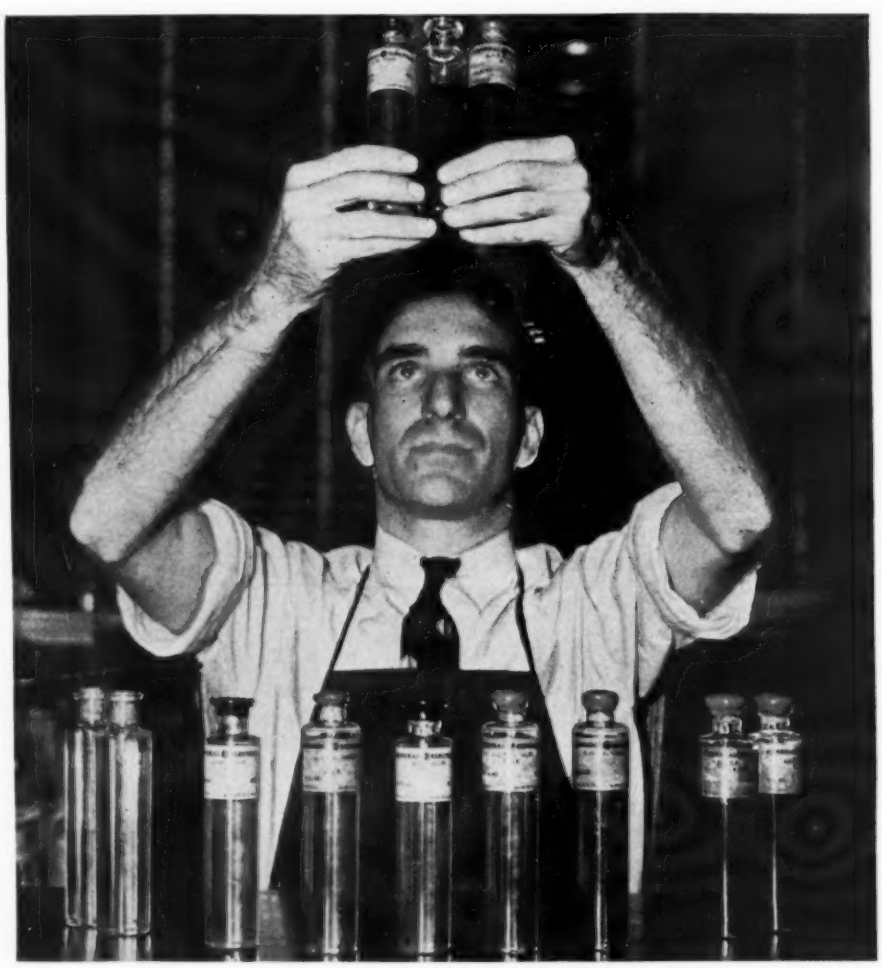
Color of the oil may indicate an abnormal condition. New transformer oil has very little color when viewed through a clear bottle approximately 1.5 in. in diameter. After 10 or 15 years in a normally operated transformer, oil should be no darker in color than lager beer. Oil that is approaching the stage where sludging may result will be slightly reddish in color. The darker it becomes, the worse its condition. Sludging of oil in transformers built during the last 20 years is rare. This results from better over-all design of modern transformers.

On water-cooled transformers, check the incoming and outgoing water temperatures weekly during the initial installation period and every three months thereafter. Temperature of cooling water going into the transformer should not exceed 25 C, and the outgoing water 10 C higher. If the water temperature rise exceeds 10 C, water flow may be insufficient. When water temperature rise is less than 10 C at the specified rate of flow, probably scale has formed within the cooling coils or oil sludge on their outside. Install thermometers permanently on the ingoing and outgoing water connections to check temperatures. If a transformer has multiple cooling coils, adjust water flow to obtain equal temperature rise in each section.

To remove scale and sediment from water-cooling coils disconnect both inlet and outlet pipes from the water system and temporarily pipe the coils to a point several feet away from the transformer. Blow or syphon all water from the coils and pump them full of a solution made of equal parts of hydrochloric acid and water. Leave one end of the coil partially open to prevent abnormal pressure which may result from the chemical action. Let solution stand in the coil for an hour and then flush out with clean water. Repeat the operation if all the scale is not removed the first time.

An oil deposit may form on the outside of the cooling coils after they have been in service for many years, especially if operating temperatures have been high. This increases oil temperatures. To remove oil deposits, take the coil out of the tank and scrape off the deposit with a small flexible chain.

Time and expense will be saved if spare transformers are kept in readiness for instant use, but the spare transformer requires maintenance just the same as one in operation. Once every six months check the oil level and its dielectric strength. Tight gaskets and breathing through a dehydrating breather, properly maintained, helps maintain dielectric strength. On conservator-type transformers, keep oil in the conservator at all times. Watch oil gages of such transformers when subzero temperatures exist. Checking these items regularly insures that the spare transformer will be ready for use when it may be needed in an emergency.



**Color is a good indication of oil conditions. Here sample is being checked against laboratory standards. New oil is almost white and changes to the color of lager beer after 10 to 15 years of service. Oil shows signs of sludging when reddish in color**

# Power—Giant Arm of Production

## *Ninety Per Cent of American Industry Is Electrified*

ELECTRICITY is the mainspring that turns the wheels of our factories, mills and mines. It is the tireless arm that grinds our grain, weaves our cloth, pumps our water, builds our planes, our guns, our ships, our cars, our trucks and tanks . . .

The mighty Pharaohs had less energy at their disposal in building their pyramids than is generated today by one single power plant. The combined capacity of America's central power systems is without parallel in the history of the world . . . 46 million kilowatts, i.e., 65 million horsepower in steam turbines, hydro turbines and other prime movers. That is more power, day in and day out, than 650 million slaves could produce—for a limited time—minutes in fact.

The capacity of this vast fountain of energy is beyond the grasp of the average man who flips a switch and sets in motion machines that perform the labor of a thousand man-hours in a matter of minutes. Perhaps only the old time farmer, whose traditional source of power is a team of tired horses and a pair of calloused hands, knows how to appreciate this commodity that is so vital an ingredient of everything we consume and use.

Yes, we take electricity for granted. We expect it to appear in unlimited quantities, like water and air, as we need it. Almost as essential as these two elements in times of peace, it becomes a matter of life and death in times of war. Industry would collapse without it and the nation would quickly perish.

With the catastrophe of Pearl Harbor a little over a year ago, came the realization that we had to out-produce our enemies. To out-produce our enemies, who had a seven year head start, meant to turn more wheels than they were turning and to turn them faster than they were turning them.

New plants sprung up overnight. Production increased beyond our wildest dreams. Aircraft and shipbuilding surpassed the most daring forecasts. The machine tool industry's output grew to a volume that bordered on the miraculous. Guns, shells, uniforms, shoes, tanks and a thousand other items were being made in hitherto undreamed of quantities. All of them have one common essential ingredient – power. Industry demanded power – more and more power!

It is no small tribute to the power industry that, while other raw materials developed shortages necessitating strict priorities control, electricity remains unrationed – no priorities, no curtailments, no rate increase. Current industrial consumption is running 16 per cent over 1941 and 50 per cent over 1940. Not spectacular perhaps but when we consider that the nation's 26 million domestic consumers utilize only about 14 per cent of the energy output, we begin to get some idea of industry's power consumption.

Our power companies might have been stunned by the prospect of mounting demands for kilowatts. Instead they set about developing and coordinating a multiplicity of relatively small and seemingly unrelated factors. Individually or even collectively, these have not been of a spectacular nature. Certainly they have not inspired the award of the Army-Navy E although they are an essential ingredient in every Army-Navy E that has been awarded to American industry.

The contribution of the power industry to the winning of the war is not likely to flame forth in newspaper headlines. It takes the more prosaic turn of portraying an industry that is doing wonders quietly, unobtrusively.

At the close of the last war the power at the disposal of the American industrial worker averaged 3⅓ horsepower. At the beginning of this war, twenty years later,

***This is the seventh of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers, and in daily newspapers in New York, Chicago and Washington, D. C. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.***

it had increased to 6½ horsepower. What other nation can even approach that figure? This large provision of power is the achievement of the electric utility industry. For years it had built and applied its equipment to the highest standards of performance and operated its systems to equally high standards of service and dependability. Always recognizing that "public service is a public trust" it had maintained wide margins of security in performance. Today these margins are the source of the power industry's ability to rise to the emergency.

In short, the electric utilities were prepared!

Power men are accustomed to looking ahead, to prepare for growing loads and allow for unforeseen contingencies, for electricity cannot be stored. It is "ordered" by touching a switch. It is delivered and consumed at the same moment.

Months before the actual outbreak of hostilities foresighted power men set to work computing how much life of equipment could be risked in the process of crowding it toward greater output. Generators, boilers, turbines, cables, transformers and even conductors underwent close scrutiny in an effort to increase the load – *safely*. They figured, they experimented, they tried untried measures.

Insulation, for example, is the crux – the least known component of electrical apparatus. When it lets go the service suffers. It is not easy to know how near any bit of crucial insulation is to letting go. It takes courage to work it to a point just short of failure . . . but that is exactly what is being done today.

Technological forcing of equipment, however, is not all of the story. Obsolescent equipment has been rehabilitated; salvage has been intensified; critical metals have been replaced by non-critical materials; water sprays, air-blowers and other cooling methods have been installed to keep over-loaded apparatus from over-heating. Nothing has been overlooked. Ingenuity has contrived the well nigh impossible.

Hand in hand with these measures of expediency have gone measures of intensification. Hydrogen pressure for cooling generators has been stepped up from ounces to pounds taking more heat away from the machines and enabling them to carry greater loads. Capacitors – little more than aluminum foil interleaved with thin paper – have been applied by the carload relieving the systems of that mysterious reactive current which is associated with that equally mysterious power factor. They have performed wonders in avoiding the need for additional generating and transforming equipment. The use of portable sub-stations has averted the otherwise necessary reserve capacity in fixed installations at many points.

When coal was placed on the urgent list last spring the electric utilities outstripped all other industries in providing storage for the winter. Stocks on hand the first of October were sufficient for 105 days, or more than twice what would be considered adequate in times of peace.

When staff losses to the armed forces became serious power companies contrived measures that enable them to get along without aggravating the national manpower situation by hiring others to replace them. Today meters are being read every two or three months instead of monthly; women are being trained to do drafting, keep the logs in power plants and sub-stations and to test meters in shops and laboratories.

On the summit of "Grandpa's Knob", a mountain overlooking Rutland, Vermont, stands a giant windmill that would have been the delight of Don Quixote. Towering 200 feet above the tree tops its mighty 175 foot propeller turns with the wind and drives a 1,000 kilowatt generator which feeds its output into the Central Vermont Public Service Corporation's power system. The most ambitious wind-turbine generator in the world, and a daring experiment of forward-looking men.

Today everything electrical is being tried; is being worked harder than it has ever been worked before.

Great credit is due the men behind the electric power industry. These men have recognized the responsibility of their jobs – it is a part of their very being. Theirs is the kind of service that *must* be maintained. No soldier is truer to his trust than is the employee of this great industry.

The service must go on! No matter what happens – acts of God or deeds of men – the service must go on! Labor disturbances may disrupt other industries but there have been no shutdowns due to labor trouble in electric power plants since Pearl Harbor.

And this winter when blizzards pile up drifts and sleet makes pavements slippery there may be absenteeism from other plants but the utility employees will be on the job ready to climb the ice-covered poles and repair the ice-laden lines whenever the call comes.

In this war the least costly yet the most precious element of production – electricity – will be ever ready to "man" the machines that will produce the weapons that will give victory to the forces of freedom.

*President, McGraw-Hill Publishing Company, Inc.*

# WARTIME POWER CLINIC

**Practical ways to create emergency capacity. Cures for overloads, breakdowns, short-handed staffs, lack of spare parts, etc. Contributions invited at regular rates**

## Morning Starter for Heating Boiler

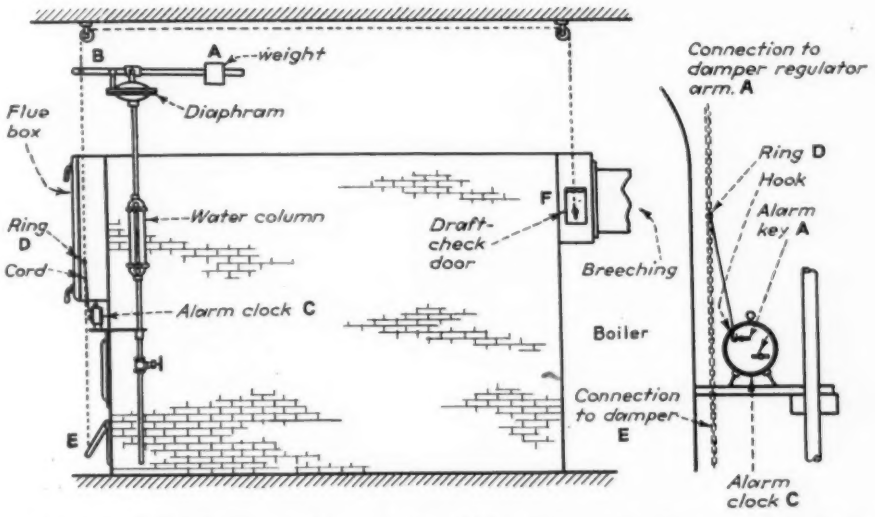
MANY A SMALL WARTIME machine shop shuts down at 6 p.m., so hires only a daytime fireman to run the low-pressure heating boiler. To save fuel and labor by night banking, yet insure a warm plant for the workers arriving in the morning, we rigged a unit of this type with an ordinary alarm clock to turn on the drafts around 4 a.m., about 2½ hours before the fireman checks in. The unit was a hand-fired firebox boiler with gravity return system.

A pressure diaphragm regulator controls damper and draft check door. Normally weight *A* on regulator arm *B* maintains 5 psi steam pressure in the day time. This permits the fireman to fire heavily at widely separated intervals and work at other jobs besides.

We bolted the alarm clock *C* firmly to a steel plate near the water column. A cord, running from a loose hook on the alarm key to ring *D* in the control chain, holds the draft system in the dead position after the fire is banked for the night.

When the alarm goes off, the turning key releases the hook, allowing *B* to rise and open damper *E* and close draft check *F*. Steam pressure is generally near 5 psi when the fireman arrives at 6:30 a.m. Regulator then takes charge of combustion rate.

*Cleveland, Ohio* A R CIOTTI




*Alarm clock C releases regulator arm B, which rises opening damper E and closing check door H until steam pressure increase to 5 psi causes regulator to restrict draft*

## Enlarged Slots Increase Stoker Capacity

WHEN THE ENGINEER MUST INCREASE his boiler capacity, but can't buy equipment, he must take drastic action. In the case of chain-grate stokers, enlarging the grate slot may be the answer. But first let's consider the alternatives.

For greater boiler output more fuel must be burned per hour. This in turn requires either feeding coal thicker or speeding up the stoker. Either of these methods delivers more coal to the stoker; if the additional coal is actually burned without change in efficiency the boiler output must necessarily increase. However, this can't be done without increasing the air supply.

When the stoker speeds up the damper must be opened wider to increase air flow in proportion. If the damper is already wide open and the fire right against the water back, speeding the stoker can't increase boiler output. It will merely waste unburned carbon to the ashpit.

On the other hand, if the damper is not wide open at the start, opening it will generally increase capacity, but may seriously cut the $CO_2$.

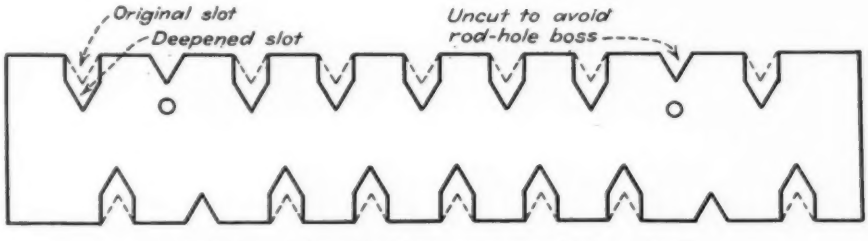
Next consider the effect of fuel-bed thickness. For a given overfire draft, there is usually one best ratio of fuel-bed thickness to grate travel. Therefore, if the thickness increases without a corresponding increase in the air supply, the stoker must be slowed down, so there may be no increase in fuel fed. Even where ample induced draft (either mechanical or natural) is available, any attempt to use it to draw the required amount of air through the thicker fuel bed may lead to excessive air infiltration through leaks in the furnace walls.

Clearly, it would help a lot if there were some way to get more air through the fire without increasing the furnace draft. There is: Part of the draft loss occurs in the grate, and this part can be reduced by enlarging the grate openings—with care and discretion.

In one plant where this was recently applied, alternate grate-link slots were deepened by a shaper as shown in the sketch. Rows of the deeply slotted links alternated with unchanged links.

Naturally an operation of this sort should be undertaken with caution. Don't overdo it. How far one can go without excessive sifting depends on lump size, the percentage of fines and amount of surface moisture in the coal. With most screenings, fired when moist enough to yield no dust when filling the hopper, the slot length may be doubled, and the slots may even be widened a little, without having to do too much sifting.

*Menard, Ill.* GEORGE HOLMAN




*Solid lines show final slot after recutting on shaper*

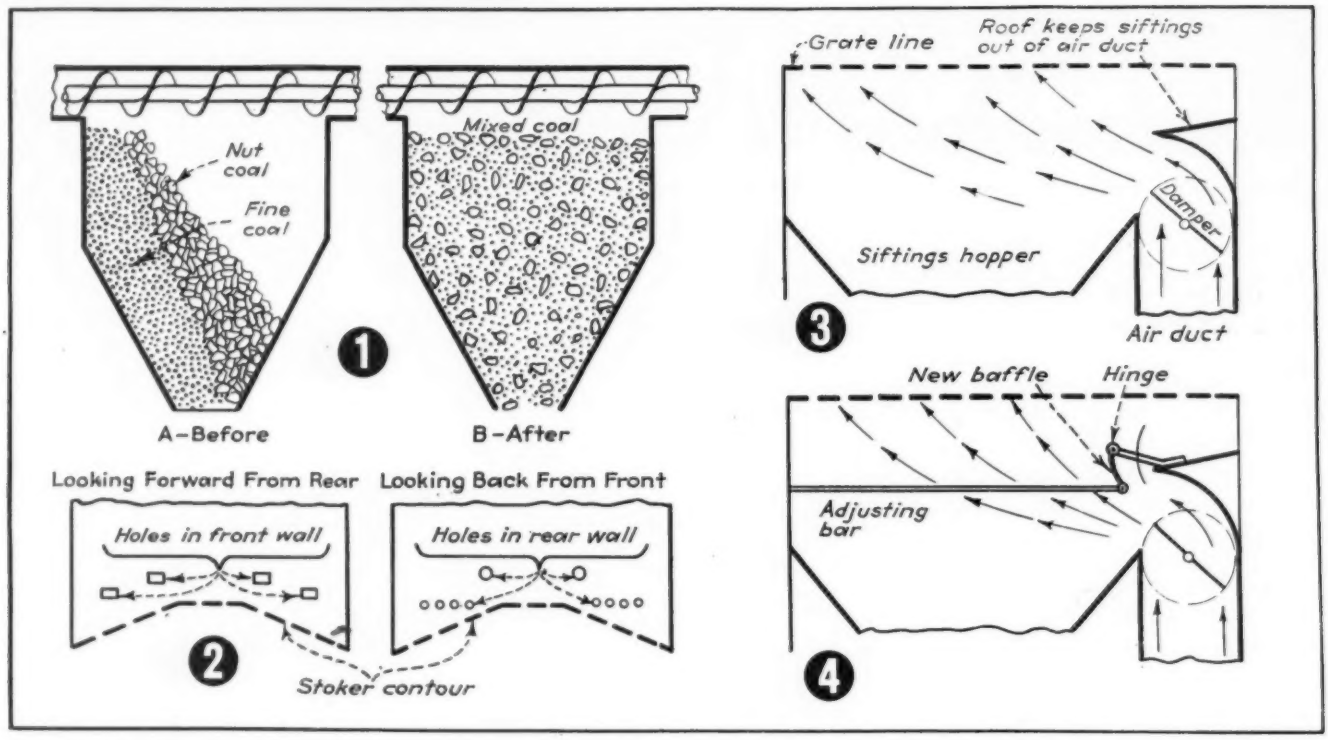



*Fig. 1—Coal segregation (A) in hopper was cured by setting timer to feed coal every ten minutes (B). Fig. 2—Air ports partly closed when stoker was installed were cleared to eliminate smoke nuisance. Fig. 3—Fixed baffle originally installed to keep siftings out of air duct "starved" air supply to rear of stoker. Fig. 4—Adjustable baffle redirects part of air to rear*

## Easy Cures for Stoker Troubles

OUR TWO SINGLE-RETORT stokers (under 5000-sq ft boilers) receive coal from 2½-ton extension hoppers. The hoppers are fed by a screw conveyor that starts with a timer switch and shuts off with a limit switch when hoppers are full.

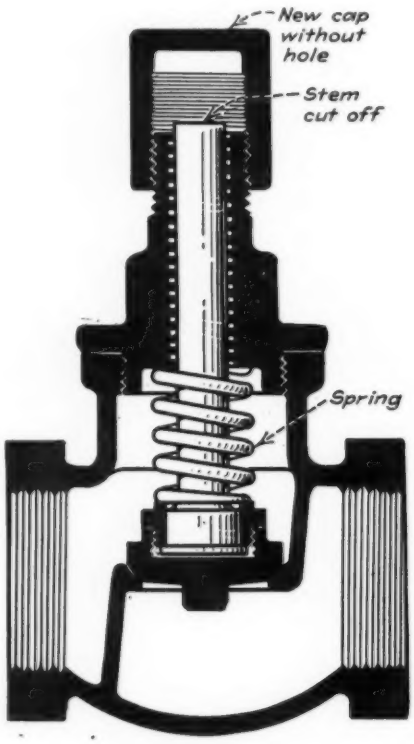
At first the timer switch was set to start the conveyor once an hour. Nut and slack coal mixed was being used and we found it impossible to keep an even fire on both sides of the stoker. One side was heavy and the other light.

We finally traced the trouble to the segregation of coal in the hoppers as shown at *A*, Fig. 1. To overcome this we set the timer to start the screw every ten minutes, thus keeping the hoppers nearly full at all times (*B*) to eliminate segregation.

Bridge walls and front walls on these stokers were built with air ports (Fig. 2) connected to the windbox to give overfire air. Thinking these ports were too large, the stoker erector half closed them with fire clay. The first week of operation ended with a call from the smoke inspector. Over the weekend these ports were opened up full with the result that nearly smokeless operation has been possible ever since.

The next trouble was uneven air distribution. The front two-thirds of the fire was much brighter than the back third. The baffle (Fig. 3) installed over the damper opening to keep siftings from dropping into the windbow directed too much of the air to the front. A small baffle (Fig. 4) adjustable from the stoker front was installed to direct more air to the rear. The fire now burns bright and free the length of the stoker.

*Rochester, N. Y.* H P KING




## Homemade Relief Valve

WHERE THE SAFETY of men and machines is involved it stands to reason that makeshifts should not be used unless absolutely necessary. Today, however, they often are necessary. The stunt shown (applied years ago) may be new to some of POWER readers.

When the old-fashioned water safeties of a steam-engine cylinder burst no replacements were obtainable, so it was necessary to rig homemade safety valves to keep the machine on the line. The sketch shows how an ordinary 1-inch globe valve was converted into a relief valve. Stem threads were turned off in a lathe. A spring was placed between bonnet and disk. Top of stem was cut off and packing nut replaced with a sealing cap.

Two of these valves are still in service. On the last test they popped at a pressure of ten pounds above boiler.

*Menard, Ill.* GEORGE HOLMAN

## Triple Keys Cure Looseness

IN TWO CASES we have corrected the loose fit of a shaft in a hole by using three keys set 120 deg apart.

First of these emergency repair jobs was a roller bearing (Fig. 1, 2, 3) on the crankshaft of one of our large air

compressors. The shaft gradually worked itself loose and began to turn in the inner raceway of the roller bearing. This slippage wore away the shaft until it was too small to fit a standard bearing.

We thought of having the shaft built up by welding, but were afraid that the heat might throw it out of true. More important, we would have to send the job 90 miles away to be machined, wasting a lot of time and production.

To avoid these difficulties, we cut three key seats in the shaft, 120 deg apart, 7/8 in. wide and full length of bearing. These keys were sunk in the shaft to a depth leaving 1/64 in. for fitting convex key surfaces to the smooth inner surface of the bearing.

We nested the keys and filed them to the required radius and height, until we could press the bearing in place. This job proved entirely satisfactory—saved time, and the shaft ran as good as new.

An even more difficult problem was a flywheel that kept working loose, wearing the shaft enough to throw the wheel out of true and cause vibration.

In normal times the right way to handle a job of this kind would be to build up the shaft, rebore the hole and then turn the shaft to fit. Since it is practically impossible to do a job of this sort in our part of the country in times like these, we had to use ingenuity. We cut two keyways in the hole 120 deg from the original keyway to hold saddle keys concaved and carefully fitted to bear smoothly on the shaft. We then drove all three keys until they held the wheel in place.

Next we turned the engine over and chalked the rim where it was out of true. Then by driving the key opposite the chalk mark, we were able to draw the rim back into line. This procedure was repeated until all three keys were tight and the rim true.

This is a solid repair and we expect no more trouble from looseness.

*Goderich, Ontario, Canada* — G BARRETT

## You'd Better Start Building Men

WE'VE SUFFERED many kinds of wartime shortages, but the worst is right ahead of us. Those who follow national trends agree that the manpower shortage will overshadow all others in 1943. How many power-plant chiefs are getting ready for what's going to hit them? Those who don't are headed for trouble, in my opinion.

This matter of hiring and training men has long been my hobby, and I want to lay some of my ideas on the line right now when they may help some other power men. Here they are:

Many power plant men have received their training right on the job. They entered this field probably because they needed work and were mechanically inclined. In most cases the first job was right down at the bottom, crawling sumps, cleaning condenser tubes, with lots of dirty hours on fouled and sooted economizer tubes.

How much they learned, how well they did the job, depended to a large extent on their own initiative and industry. But the guidance and assistance of good supervision played an important part in their learning experience.

Conscientious supervision goes far beyond an occasional inspection tour and casual acquaintance with the men. The chief engineer who takes an honest interest in the work and progress of every man under him can be a fine instructor in the schoolroom of practical experience. At best, supervision is a partnership in which the man and his chief work together.

For many years, now, I have been convinced that our modern methods of education should be supplemented by thorough practical training right in the field. During these years I have trained many men, and in the process I have developed some fairly reliable rules of procedure.

For the man who not only wants to advance as a power plant operator the following has proven to be a good training program: One year in the boiler room and general plant, washing boilers, removing ashes, cleaning economizers and superheaters. Two years of boiler operation. One year of plant maintenance. One year of oiling and cleaning equipment. One year as utility engineer.

At the end of this practical course, accompanied by night study at a vocational school or through a university extension division, this man is well qualified to assume responsibilities of his own.

Our educational system provides the methods of analysis for problems of a technical nature, and we must have this training to design, construct and operate efficiently. But you can't take the knock out of an engine with a slide rule; nor can you operate that modern boiler from the drawing board.

*Milwaukee, Wis.* LLOYD A CORWIN
Chief Engineer,
Froedtert Grain and Malting Co

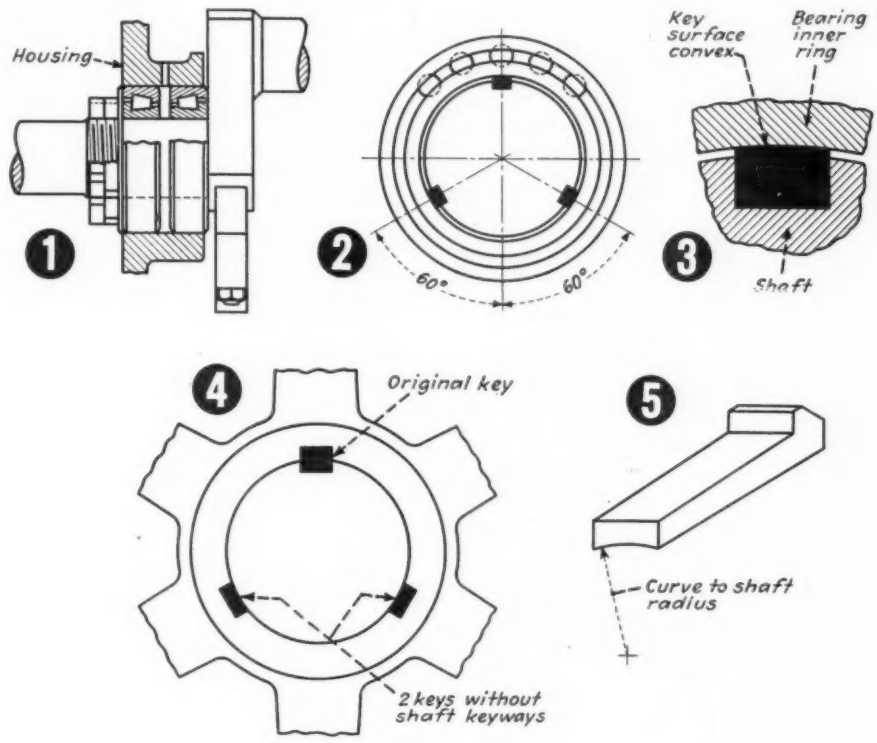
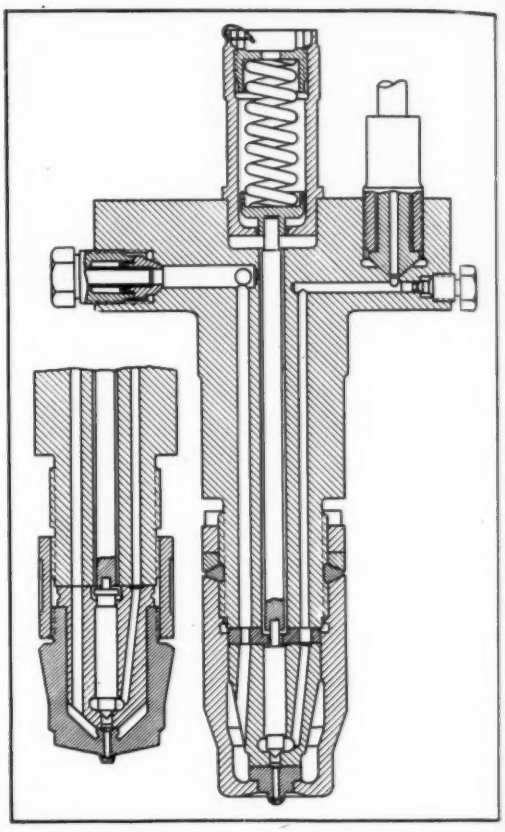



*Fig. 1—Inner race worked loose on shaft. Fig. 2 and 3—Three keyways 120 deg apart, were cut and fitted with keys having convex outer surface to grip bearing. Fig. 4 and 5—When flywheel worked loose on another shaft two additional keyways were cut 120 deg apart in bore of wheel and fitted with keys concaved inside*

# Diesel Nozzle for Two Fuels

***O T Sygall gives data on an engine in a Roumanian municipal plant designed to inject heavy fuel oil with light pilot oil***



► EUROPEAN CONDITIONS often place a premium on ability to burn low-grade fuel in internal-combustion engines. The MAN diesel installed in 1940 at Kisineff, Bessarabia, USSR (now Roumania), is an interesting example.

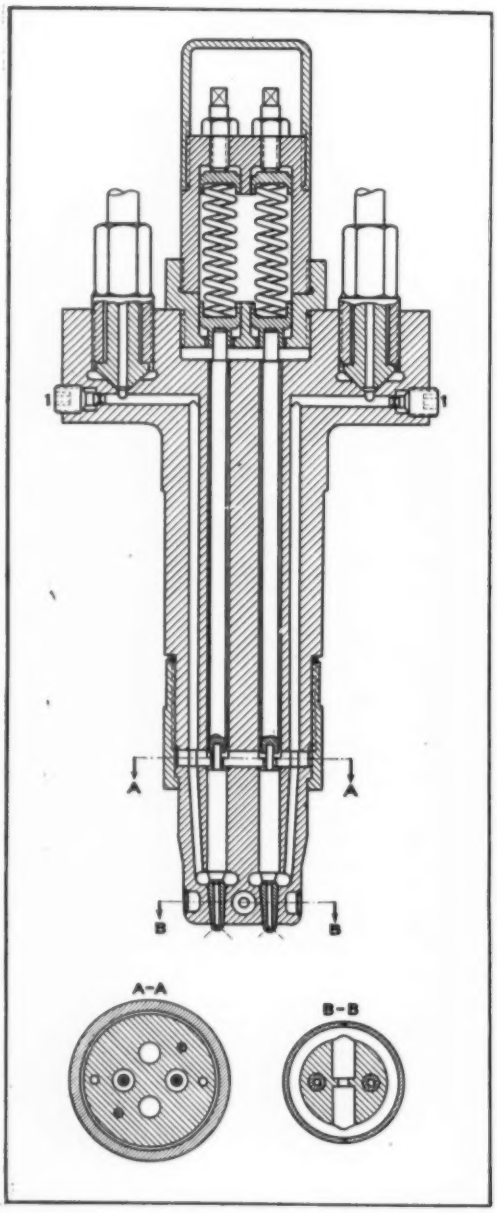
This 7-cyl 14⅜x22-in. 300-rpm 900-hp engine drives a 50-cycle 3-phase 6000-volt generator. To handle heavy fuel the engine is equipped with nozzles which permit injection of a light pilot fuel simultaneously with the heavy oil. The pilot fuel helps to maintain ignition and stabilizes combustion. The heavy fuel oil has the following characteristics:

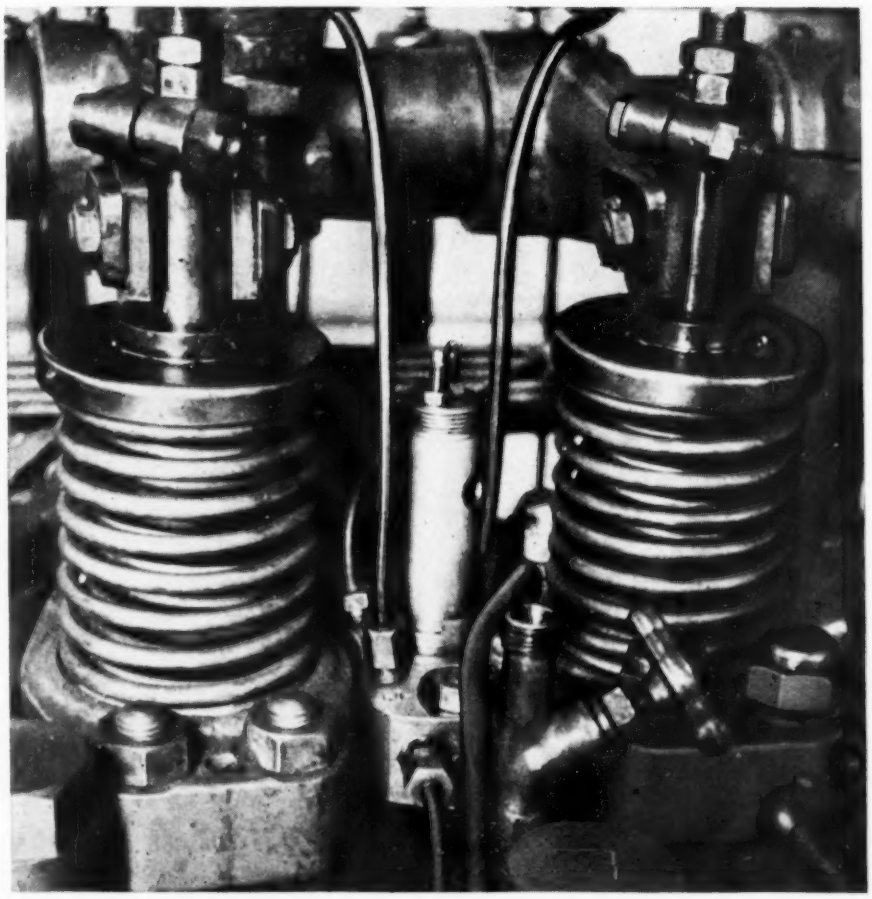
| | |
|---|---|
| Specific gravity | 0.959 |
| Viscosity (Saybolt Furol, 122 F) | 170 |
| Water, % | 0.3 |
| Asphalt, % | 8.6 |
| Paraffin, % | 6.3 |
| Sulphur, % | 2.9 |
| Conradson carbon, % | 13 |
| Heating value, Btu per lb. | 17.650 |

Pilot-oil characteristics are:

| | |
|---|---|
| Specific gravity | 0.850 |
| Heating value, Btu per lb. | 19.200 |

**Drawing at left shows water-cooled dual-fuel nozzle construction. Nozzle appears in place on engine in photo below. Drawings at right illustrate construction of conventional water-cooled nozzles; detail at left shows a later improved design**



# Your Scrap Job for 1943

***War production in 1943 will lean heavily on industrial scrap collection. Right through the year top executives will expect power men to help them "get in the scrap". Here are suggestions***

▶ EVERY POWER MAN will find that industrial scrap collection is a regular part of his job throughout 1943. To insure enough metals and other scarce materials to lick the Axis, the War Production Board is enlisting the cooperation of top industrial management everywhere to "get in the scrap". Power men everywhere—in industry and in the utilities—must size up the situation now and get ready for active cooperation when the executives of their various companies order action.

Future articles will go into many practical details. For a starter, here's what it's all about, in brief:

### *Scrap for Steel*

Consider steel, a primary objective. Steel is normally made of 50% pig iron, 25% steel-mill scrap, and 25% iron and steel scrap from outside. Steel can't be made 100% from pig iron because there isn't enough blast furnace capacity.

It would be wrong to suggest that iron and steel scrap is the only object of this scrap drive. Almost equally important are many other critical materials, including rubber, tin, copper, brass, lead, zinc, aluminum, burlap, manila rope, rags, waste fats and greases.

To meet this situation, War Production Board set up a continuing program for scrap collection under its Conservation Division. This has four sections. The Special Project Salvage Section takes care of abandoned bridges, buildings, trolley and railroad lines, etc.

The Automobile Graveyard Section keeps an eye on the heaps of discarded jalopies to make sure that each "graveyard" scraps as many cars within 60 days as it buys, shipping out the scrap iron, brass, lead and rubber and keeping only the useable parts. The General Salvage Section covers homes and farms.

Most important of all in quality and tonnage of collections, is the Industrial Salvage Section. Concerned with the recovery of scrap materials from industrial plants, railroads, mines, utilities and shipyards, this section is out after "production" and "dormant" scrap.

### *Dormant Scrap*

Production scrap is no problem, and generally does not involve the power engineer. Dormant scrap, on the other hand, does, very much. Dormant scrap consists of any machines, tools, equipment, jigs or strategic materials that are not working on a war production job and are not likely to be used in the near future. A better definition is implied in this slogan: "If it hasn't been used for three months, and if someone can't prove that it's going to be used in the next three, use it or scrap it."

The scrap collection must be organized. To insure success it should be backed by a top executive—not less than a vice president—with full authority to decide what can be scrapped. He should head a committee made up of various department heads, including the power engineer. Details from here on can be varied to suit circumstances, but one plant found it best to march the committee right through the plant, accompanied (in each department) by the foreman of the department. All idle machines and materials were questioned. "Have they been used in three months; will they be used in three months?" If not, they were scrapped.

By the way, this "scrapping" does not necessarily mean remelting. A secondhand machine may well go to another manufacturer or to a dealer.

Since the top executives in most industrial establishments will soon initiate scrap collection programs, one may ask whether the power engineer should start one on his own. We would say yes, but with discretion.

If the power engineer has not yet heard from his president or vice-president in this connection, let him proceed at once to look over all power equipment and supplies to see what can be spared. Then let him write a memorandum to the executive suggesting the scrapping of this material and listing it in detail.

The same memo can make it clear that the engineer stands prepared to fit his departmental program into any scrap collection plan that may be laid down by the company executive. This statement will serve to keep the engineer on the map as a self-starter, without placing him in conflict with any company plans that may be developed.

### *Comment Invited*

Because there's a job to be done, POWER plans to report this scrap situation every month. Readers are invited to tell what they are doing about it, with emphasis on practical details.

# Heat Tightens Turbine Bolts Safely

***High-temperature bolts are electrically heated to avoid heavy wrenching. E F Miller of Westinghouse discusses some of the problems of bolting and methods of increasing bolt strength as much as 40%***

▶WE HAVE ONLY RECENTLY recognized that materials subject to stress at high temperature, such as turbine bolting, should also have resistance to shock and fatigue, dynamic properties heretofore thought necessary only where sudden or repeated stresses were encountered. A bolt, if stressed during installation, will quickly lose part of its stress due to relaxation when subjected to high temperature. A brittle alloy relaxes much more slowly than a ductile one, yet a too brittle material is not suitable.

A material with as high a relaxation resistance as possible should be used in order to sustain loads that will prevent the joints from leaking over a reasonable period of time and yet not unduly jeopardize security from failure in service.

### *Compromise Alloy*

A satisfactory compromise is reached when a material having high strength at the operating temperatures encountered is so heat treated as to retain an Izod impact value of at least 25 ft lb at room temperature. As a result of such processing it is still more sensitive to the effects of combined stresses and stress concentration than are the more ductile materials commonly used for low-temperature applications. It is desirable, therefore, to eliminate, insofar as possible, bending and torsional stresses and to reduce stress concentration to a minimum.

Load transfers to the body of a bolt by shearing stresses in the threads. It would obviously be ideal to have each thread contribute a uniform share so that the body of the bolt would be gradually loaded throughout thread length.

If one considers that the bolt within the nut is in tension while the nut is in compression and that the resulting elastic deformations in the two elements are opposed to a uniform thread loading, it is easy to understand why in a conventional bolt and nut the first thread engaging the nut carries a much larger share of the load than any successive thread and that the load rapidly decreases over the remaining threads. Thus the transfer of load from threads to bolt tends to concentrate in a narrow band in the region of the nut bearing face.

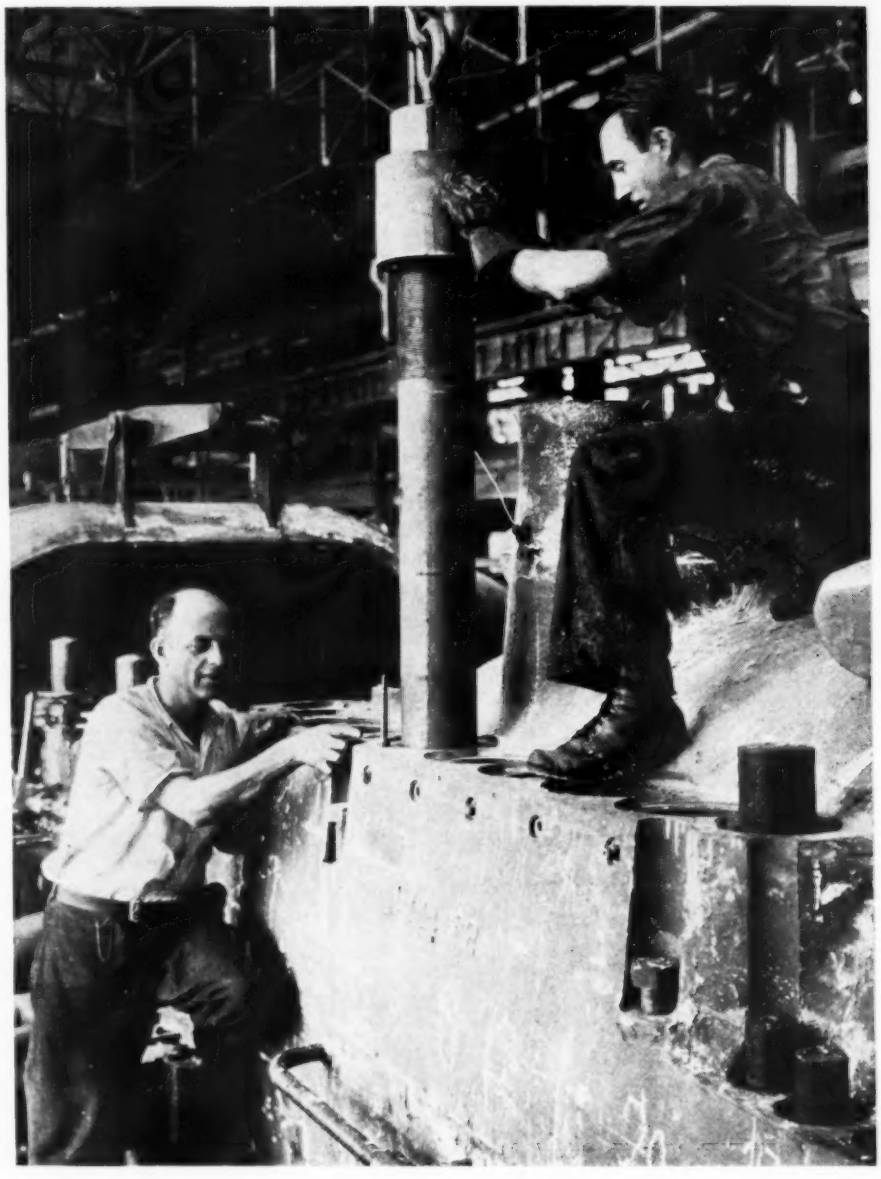


**Fig. 1—Lowering a large stud bolt into place in the horizontal flange joint of a large high-pressure turbine cylinder for high-temperature service**

The above reasoning is modified somewhat when considering elastic thread distortion and nut spreading. Thread distortion will only partly relieve this situation since naturally the first thread will suffer the most deformation and will still carry a disproportionate share of the load. Nut spreading, however, will further improve the distribution. Tests made with relatively thin-wall nuts have shown remarkably uniform load distribution with measurable increase of the nut

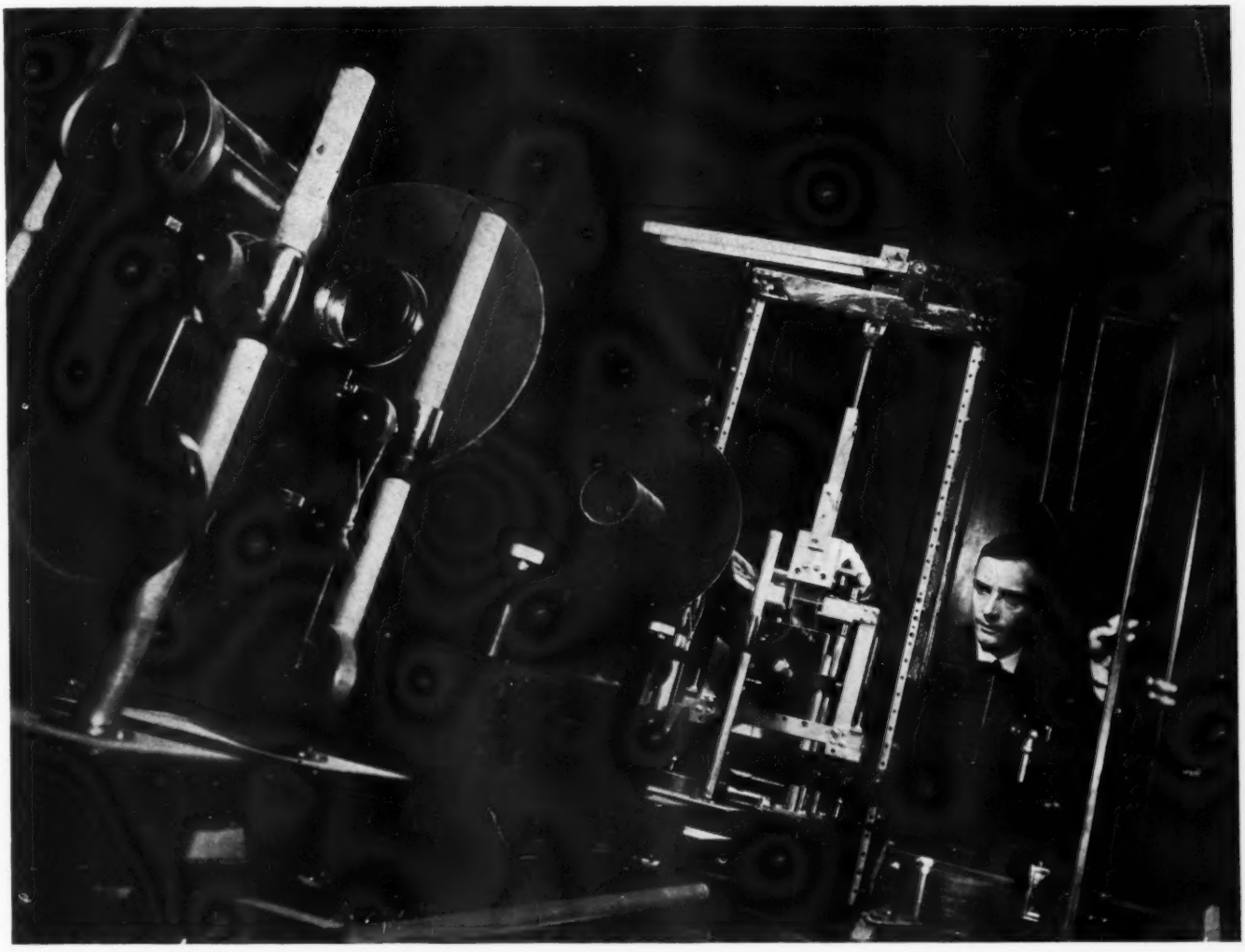


**Fig. 2—Three-dimensional photo-elastic analysis helps engineers determine best design for steam-turbine bolts. Stress lines from center slices of transparent bakelite bolt models are seen by polarized light. Maximum stress is nearest nut-bearing face**

diameter at the bearing face, with a gradual decrease toward the top of the nut.

This spreading effect cannot be obtained in a forging or casting into which studs are driven, but by reverse-tapering the threaded portion of the stud end so that the thread at the end of the stud is loaded first and as the stud stretches, succeeding threads take on load, a substantially uniform loading may be obtained. Such a stud must be designed to bottom in the tapped hole since the usual shoulder provided for limiting the depth of drive is eliminated to reduce stress concentration.

### *Special Threading*

Nuts with walls as thin as consistent with strength requirements, and tapered stud ends which bottom in the hole are now recognized as standard in the design of large bolting for high-temperature application.

A change in general thread form appears to offer no advantage since the standard "V" thread provides maximum shear area for a given thread length and provides the nearest approach to mating cantilevers of uniform strength. The 30-deg bearing faces provide radial components of force to effect desirable spreading of the nuts and are more easily machined accurately than are other thread forms. Stress concentration at the root of the threads may be decreased, however, by providing a radius at the root instead of the conventional flat-bottom thread with sharp corners. This is present practice on male threads.

Tensile tests of bars with widely spaced sharp circumferential grooves indicate high stress concentration and low strength whereas a fully threaded bar shows little reduction in strength over a smooth bar of a diameter corresponding to the root diameter of the threaded specimen. Thus, common practice suggests threading small bolts full length. This proves impractical on large bolts for obvious reasons, but, it is desirable to continue the threads well beyond the nut face so that termination of the threads occurs well outside the zone of transition from shearing stresses in the threads to tensile stress in the bolt. The thread length is therefore made 1½ times as long as the diameter of the bolt, whereas the length of the thread grip is substantially one diameter.

The body of the bolt between the threaded ends is reduced slightly below the root of the threads and joined to the threaded ends by a large radius, tangent to the body of the bolt. Radius approximates ⅓ of the bolt diameter. The body is carefully finished to avoid scratches which could cause stress concentration.

### *Bearing of Nut Faces*

It is important that the nut faces bear uniformly on the flanges. This is not so difficult when stud bolts are employed with nuts on both ends since spot facing is a relatively accurate operation and the bolt is free to accommodate itself within the clearance hole provided. However, when uniform bearing is not obtained, it is common practice to provide tapered washers to correct the discrepancy and these are tack

welded to the flanges to prevent them from moving. A stud, however, being relatively fixed at one end, cannot accommodate itself to even slight misalignment and large studs are therefore provided with convex spherical washers mating with concave spherical seats in the nut faces. This provision insures a universal self-aligning assembly to take the bolt load.

Alloy steel bolts should be installed with a predetermined stress which corresponds to a definite stretch. This stretch should be measured to assure uniformity.

### *Preheating for Set-Up*

Tightening large bolts without heating is extremely difficult and requires heavy wrenches with extension-pipe handles. In some cases pulleys, ropes, and cranes have been employed. In close quarters slugging wrenches and heavy hammers have been used.

Tightening by these methods produces bending, torsional, and shock strains which, when combined with the normal tension required in the functioning of a bolting element, detracts from the dependability of the bolt in service. This is particularly undesirable in the case of high-temperature bolting where ductility and shock resistance may have been sacrificed in some degree for desirable creep or relaxation properties. Engineers now consider the presence of such torsional and secondary stresses to be so detrimental to safety that tightening by torsional means is no longer permitted.

The practice of heating large bolts to increase their length, and after turning the nuts tight allowing the bolts to cool, is generally recognized as the desirable procedure to obtain a uniform predetermined bolt set-up stress with a minimum of secondary stresses.

Several methods have been used for obtaining stretch by heating. Bolts have been heated before insertion by means of furnaces, torches, or resistance coils. This requires careful control of the temperature and a minimum loss of time in installing a bolt. The procedure is not recommended since results are unpredictable and the same method cannot be employed in removing the bolts.

An accepted procedure involves provision of holes through bolts for heating them in place. The bolts are initially installed with only sufficient torque on the nuts to assure intimate contact between the flange faces and nut bearing surfaces. The bolts are then heated and nuts turned a predetermined amount depending on the desired stretch with an allowance for flange compression and other accompanying distortions.

**Fig. 3—The author holds heater element used to extend large alloy-steel bolt length at installation to avoid heavy wrenching when tightening the nuts**

Various methods of heating have been employed. Hot air has been blown into the bolt heating hole, the air having been heated in a coil furnace. The use of superheated steam has been considered. Flame from a torch has been directed into the heating hole. Electric resistance elements have been inserted in the bolts.

The electric resistance heater has been most satisfactory and is now a standard method of heating. Two types have heretofore been employed.

Heating elements consisting of coiled resistance wires imbedded in an insulating cement inside of metallic tubes and operating on standard voltages have been used for light stretching of bolts. The capacity of this type of heater is relatively low and a steady state is soon reached in which the bolt loses heat to flanges and surrounding parts as fast as it is received from the heater and full tightening of large bolts is difficult to obtain.

Heaters made from rods of resistance alloys or carbon have been used with success. These heaters were centered in the bolt holes by narrow insulating bands and usually completed the electrical circuit by contact with the bottom of a dead-end heating hole. Electrical connections were made to the flange and to the end of the heating element which protruded from the bolt. These heaters could be operated with sufficient capacity to heat the bolts rapidly since the flow of heat was not impeded by an insulating material. The wall of the bolt hole could "see" the hot rod and full radiating effect was obtained. These heaters because of their low resistance required heavy current at low voltage and, therefore, required heavy and cumbersome leads and expensive transformers.

Because of contact of the element in the bottom of the bolt hole, any disturbance of the heater which broke this contact, resulted in burning the bolt at this point. Since the bottom of the hole was often used for a micrometer measurement of the bolt length, readings were often misleading.

The need for a slender cylindrical electric heater of high output for operation on standard voltages led to development of a helically wound resistance element in which the heating coil is not shielded from the surface to be heated by an interposed insulating substance. Thus the temperature gradient normally required to conduct the heat through an insulating material was eliminated and for a given heating rate the temperature of the coil may be lower, or conversely, for a given temperature a higher heating rate becomes possible.

This is accomplished by employing a tubular ceramic insulating core with deep helical grooves into which resistance wire is wound. Flat-topped lands between the grooves extend radially beyond the outside diameter of the coil and prevent contact of the coil with the surface to be heated.

### *Heaters Sized to Suit*

The heaters are designed for use in hole sizes of one fourth of the nominal bolt diameter. A satisfactory heating rate is obtained with a capacity of 50 watts per inch of bolt diameter per inch of length. With this input, sufficient heating is obtained for normal bolt set-up requirements in about five minutes per inch of bolt diameter. Thus a 3-in. bolt requires about 15 minutes and a 6-in. bolt about 30 minutes, varying somewhat with the amount of tightening desired and the physical proportions of the flanges.

Flexible lead wires are heavy and rigid enough to use in handling the heaters and tying them in place when necessary to use them in an upside-down position. Heaters are now available for bolts from 1½ to 6-inch diameter and in the largest size up to 5 ft in length. The output ranges from 0.9 to 18 kw.

# THE OPERATING ENGINEER

George Edwards
*Advisory Editor*

PRACTICAL AIDS • MAINTENANCE HINTS • QUESTIONS—ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

# Hospital Cleanliness Pays Dividends

***Mount Sinai Hospital supervising engineer says: "Keep the machines clean and don't waste time on useless reports. Make your records supply information that shows how to reduce operating costs and improve service"***

THE MOUNT SINAI HOSPITAL, organized and incorporated on Jan 14, 1852, began in a 4-story building on 28th Street, accommodating 45 patients. In 1871 the hospital moved to a building on Lexington Avenue with a 200-bed capacity. The nucleus of the present group of buildings opened in 1904 with 500 beds. Later additions and new construction brought the hospital to its present capacity of 856 beds. It now occupies 18 buildings taking in most of three city blocks from 98th to 101st Streets along Fifth Avenue in New York city. The full staff consists of 900 physicians, surgeons, and laboratory scientists, and an administrative, nursing and service personnel of 1400.

An institution of this size requires practically every kind of power service. High vacuum service is needed in the laboratories for research and in the operating rooms for general purposes. Compressed air furnishes power for dental and surgical instruments as well as for heavier general utility tools. Direct current serves for general lighting and power; purchased alternating current furnishes power for x-rays, radiotherapy and other special purposes. Steam furnishes building heat, cooking, laundry, domestic water heating, and sterilizing service. Electrical and steam-operated equipment supplies power for air conditioning, refrigeration, elevators, pumping, carpenter shop and machine-shop tools.

All power, except a small amount of purchased alternating current, comes from the hospital power plant. Steam is generated at 120 psi in five oil-fired watertube boilers having a total capacity of 2154 hp. Individual boiler capacities are 400, 531, 346, 373 and 504 hp respectively. Normal steam load requires one large and one small boiler. Furnace stack is protected by a smoke indicator and alarm that warns the fireman of smoking discharge.

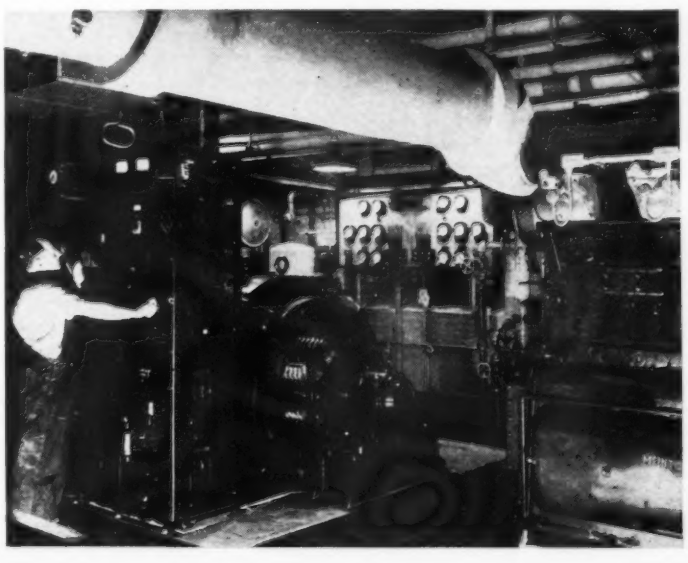
Electric power-generating equipment consists of two Elliott 250-kw 180-rpm 1000-amp 250-volt dc generators direct-connected to 430-hp 100-psi 23 x 24-in. steam non-releasing Corliss Elliott engines operating against 12 psi absolute backpressure and two Crocker-Wheeler 350-kw 400-rpm 1400-amp dc genera-

**Fig. 1—Diesel log contains information used in computing costs and fuel rate. P Brien prepares to parallel another unit**

ENGINE NO. 2 — THE MOUNT SINAI HOSPITAL — DIESEL PLANT WATCH LOG — DATE 10-30-42

| TIME | CYLINDER EXHAUST TEMPS 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | CYLINDER WATER TEMPS 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | AMPS + | AMPS − | WATT METER | % LOAD | % RATE | FUEL OIL METER | FUEL OIL GALS | FUEL OIL PRESS | FUEL OIL BY G. W. | LUB. OIL PRESS | LUB. OIL TEMP OUTL. | LUB. OIL TEMP INL. | WATER TEMPS INLET | WATER TEMPS TO GOOD-RS | WATER TEMPS FROM COILS | WATER TEMPS TO ENGINE | WATER TEMPS FROM ENGINE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 A.M. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9.00 | 470 | | | | | | | | | | | | | | | | | | | | | | | | 4 | 144 | 139 | 52 | 52 | 104 | 139 | 147 |
| 10.00 | 490 | | | | | | | | | | | | | | | | | | | | | | | | 3 | 150 | 140 | 52 | 52 | 106 | 140 | 148 |
| 11.00 | 480 | | | | | | | | | | | | | | | | | | | | | | | | 3 | 150 | 140 | 52 | 52 | 102 | 134 | 142 |
| 12 N. | 480 | | | | | | | | | | | | | | | | | | | | | | | | 11 | 151 | 140 | 52 | 52 | 104 | 137 | 145 |
| 1.00 | 420 | | | | | | | | | | | | | | | | | | | | | | | | 6 | 150 | 139 | 52 | 52 | 104 | 135 | 142 |
| 2.00 | 460 | | | | | | | | | | | | | | | | | | | | | | | | 6 | 151 | 140 | 52 | 52 | 104 | 137 | 145 |
| 3.00 | 430 | | | | | | | | | | | | | | | | | | | | | | | | 6 | 151 | 139 | 52 | 52 | 106 | 138 | 145 |
| 4.00 | 460 | | | | | | | | | | | | | | | | | | | | | | | | 6 | 151 | 139 | 52 | 52 | 106 | 135 | 142 |
| 5.00 | [illegible] | | | | | | | | | | | | | | | | | | | | | | | | 6 | 150 | 138 | 52 | 52 | 106 | 136 | 141 |
| 6.00 | [illegible] | | | | | | | | | | | | | | | | | | | | | | | | 6 | 150 | 138 | 52 | 52 | 108 | 138 | 145 |
| 7.00 | 390 | | | | | | | | | | | | | | | | | | | | | | | | 6 | 150 | 138 | 52 | 52 | 104 | 133 | 140 |
| 8.00 | 380 | | | | | | | | | | | | | | | | | | | | | | | | 6 | 150 | 138 | 52 | 52 | 106 | 137 | 144 |
| 9.00 | [illegible] | | | | | | | | | | | | | | | | | | | | | | | | 6 | 150 | 138 | 52 | 52 | 108 | 139 | 146 |
| 10.00 | [illegible] | | | | | | | | | | | | | | | | | | | | | | | | 6 | 150 | 138 | 52 | 52 | 104 | 133 | 140 |
| 11.00 | 460 | | | | | | | | | | | | | | | | | | | | | | | | 0 | 150 | 138 | 52 | 52 | 108 | 139 | 147 |
| 12 M. | 370 | | | | | | | | | | | | | | | | | | | | | | | | 10 | 150 | 138 | 52 | 52 | 106 | 135 | 142 |
| 1.00 | 390 | | | | | | | | | | | | | | | | | | | | | | | | 10 | 150 | 138 | 52 | 52 | 104 | 132 | 145 |
| 2.00 | 360 | | | | | | | | | | | | | | | | | | | | | | | | 10 | 150 | 138 | 52 | 52 | 104 | 132 | 145 |
| 3.00 | 350 | | | | | | | | | | | | | | | | | | | | | | | | 0 | 150 | 138 | 52 | 52 | 108 | 138 | 144 |
| 4.00 | 370 | | | | | | | | | | | | | | | | | | | | | | | | 10 | 150 | 138 | 52 | 52 | 108 | 138 | 144 |
| 5.00 | 390 | | | | | | | | | | | | | | | | | | | | | | | | [illegible] | | | | | | | | |
| 6.00 | 400 | | | | | | | | | | | | | | | | | | | | | | | | 10 | 150 | 138 | 52 | 52 | 108 | 137 | 144 |
| 7.00 | 390 | | | | | | | | | | | | | | | | | | | | | | | | 10 | 150 | 138 | 52 | 52 | 104 | 134 | 142 |
| TOTAL K.W.H. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| REMARKS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | |
|---|---|
| TOTAL PREV. HRS. RUN | 17072 |
| TOTAL HRS. RUN THIS DAY | 23 |
| GRAND TOTAL HRS. RUN | 17095 |
| **FUEL OIL** | |
| OIL IN TANK 8:00 A.M. | 14357 |
| OIL REC'D. THIS DATE | — |
| TOTAL FUEL OIL | 14357 |
| OIL USED THIS DATE | 495 |
| BALANCE ON HAND | 13862 |
| **LUBRICATING OIL** | |
| MAKEUP—GALS. | |
| OIL CHANGED—DATE | |
| CLEANING TIME—HRS. | |
| **SUMMARY** | |
| TOTAL K. W. GEN. | 3370 |
| K. W. PER GAL. OIL | 10.2 |
| ENGR. 1ST WATCH | |
| ENGR. 2ND WATCH | |
| ENGR. 3RD WATCH | |



tors direct-connected to 500-hp 400-rpm 12½ x 13-in. 8-cyl McIntosh & Seymour diesel engines.

Steam engine and steam-driven auxiliary exhaust supplies building heat as well as heating water for domestic and laundry purposes. Diesel engine jacket water also provides hot water for domestic purposes. A hand-controlled live steam connection to the heating header permits using live steam when and if needed. Hot-water and direct-steam radiation furnishes heat to some buildings while others are supplied by indirect air heating over steam or water coils located in the basement. Condensate from the heating system, together with partial returns from other services, accounts for 90% of boiler feed requirements.

### *Winter Operation*

During winter months one diesel and one steam unit, or two steam units, carry the electrical load, allowing adjustment of loading on the reciprocating engine to supply steam-heating requirements. Small increment changes in heating load are corrected by operating either motor or steam-driven auxiliaries. A close watch on the atmospheric exhaust prevents steam discharge to waste.

Engine room log sheets provide means for recording important load data including a continuous operating history of the equipment. Breakdowns, repairs, cleaning and adjustments to machines are entered by each shift in spaces on the log sheet. Information secured from these sheets serves as a basis to compute steam requirements, power generated, diesel oil rate and boiler evaporation per pound of oil.

Fuel oil used in the boilers and diesels is metered for daily consumption but accurately calibrated fuel-tank readings provide positive data for evaporation rates. Feedwater to all boilers passes through one common venturi flowmeter. Inspecting, cleaning, and rechecking this instrument twice a year keeps it registering accurately.

Steam consumption of auxiliary pumps and compressors is calculated from a constant derived from actual indicator diagrams. Mechanical counters register the number of strokes and this total multiplied by the steam constant gives the daily steam usage. Motor-driven vacuum pumps and compressors are also equipped with counters. While the counter method cannot be recommended for acceptance-test accuracy it provides readings of sufficient correctness for comparing plant operation over stated intervals. Part of the yearly inspection work consists of taking new indicator diagrams or metering the motor input to check the original power constant.

### *Inspection Procedure*

Supervising Engineer J B Cubberley, in charge of the power plant and responsible for all building and equipment repairs, has a well laid out plan of inspection and maintenance. Past experience has shown the fallacy of using a planned schedule of equipment outage for inspection purposes. Although this plan permits using impressive wall charts, unforeseen occurrences often upset the schedule and, once thrown out of gear, the chart plan soon becomes obsolete. He has also found the uselessness of having numerous inspection blanks listing points to be checked on each machine. Returning the blank nicely filled in is no assurance that the equipment was thoroughly inspected unless the individual is competent and

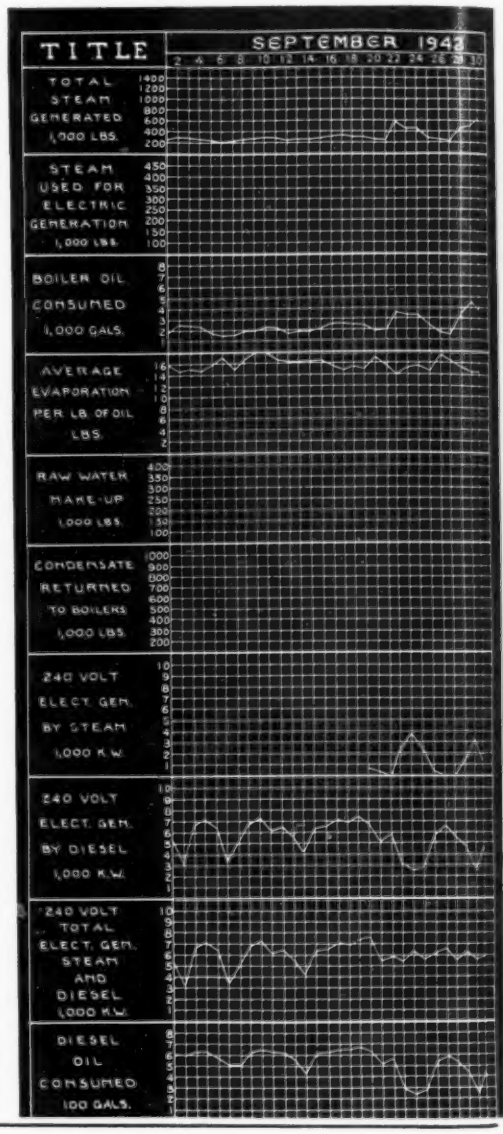

TITLE
SEPTEMBER 1942
TOTAL STEAM GENERATED 1,000 LBS.
STEAM USED FOR ELECTRIC GENERATION 1,000 LBS.
BOILER OIL CONSUMED 1,000 GALS.
AVERAGE EVAPORATION PER LB. OF OIL LBS.
RAW WATER MAKE-UP 1,000 LBS.
CONDENSATE RETURNED TO BOILERS 1,000 LBS.
240 VOLT ELECT. GEN. BY STEAM 1,000 K.W.
240 VOLT ELECT. GEN. BY DIESEL 1,000 K.W.
240 VOLT TOTAL ELECT. GEN. STEAM AND DIESEL 1,000 K.W.
DIESEL OIL CONSUMED 100 GALS.

Fig. 2—Steam and refrigerating system log sheet provides operating data, including a complete record of repairs. Daily totals are transferred to monthly charts

WEATHER
MEAN TEMP.
CONDITIONS

## THE MOUNT SINAI HOSPITAL

BOILERS — ENGINES AND

| TIME | BOILERS OPERATING 1 2 3 4 5 | AVERAGE RATINGS 1 2 3 4 5 | STEAM FLOW METER INTEGRATORS 1 2 3 4 5 | FEED WATER METERS CITY MAKE-UP CUB. FT. | FEED WATER METERS VENTURI GALS. | FEED WATER TEMP. | FUEL OIL AT BURNERS METERS AT BOILERS—GALS. 1 2 3 4 5 | FUEL OIL AT BURNERS TEMP. | FUEL OIL AT BURNERS PRESS. | ENGINES OPERATING 1 2 3 4 | AMMETER READINGS — 240 VOLTS ENGINE 1 + − | ENGINE 2 + − | ENGINE 3 + − | ENGINE 4 + − |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8:00 A.M. | ✓ ✓ | 90 100 | 3831 3855 | | 765200 | 196 | 838410 754330 | 206 | 110 | ✓ ✓ | 500 600 | 600 600 | 400 500 | |
| 9:00 | ✓ ✓ | 95 110 | 46 67 | | 490 | 204 | 570 450 | 206 | 110 | ✓ ✓ | 800 1000 | | 700 900 | |
| 10:00 | ✓ ✓ | 90 105 | 62 80 | | 820 | 198 | 730 570 | 206 | 105 | ✓ ✓ | 800 1000 | | | |
| 11:00 | | | | | | | | | | | | | | |
| 12:00 | | | | | | | | | | | | | | |
| 7:00 | ✓ | 95 | 4039 4607 | | 769830 | 196 | 840560 755830 | 204 | 90 | ✓ | 600 800 | | | |

| FUEL OIL GALS. | | | |
|---|---|---|---|
| RECEIVED | #2 | 8'-2" | 19794 |
| USED | #3 | 7'-2" | 11211 |
| BALANCE | #4 | 5'-3" | 7761 |
| CHECK | | Total | 33716 |

| DEISEL OIL GALS. | |
|---|---|
| RECEIVED | |
| USED | |
| BALANCE | |
| CHECK | |

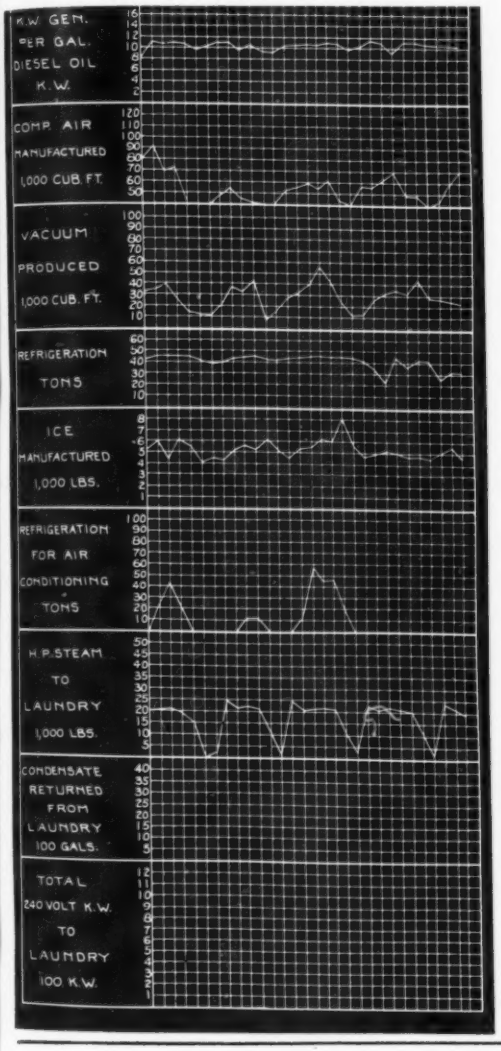
FIRST WATCH
#2+3 boilers blown down
#2 engine on line at 8 AM
#3 " off " 8:00 AM
#3 " on " 12:30 PM Off steam off at 12:15 PM
#4 " off " 12:30 PM #3 boiler off at 12:30 PM

SECOND WATCH

SIGNED

trustworthy; if he is such a person, he can be depended upon and the blank then serves no useful purpose. Time spent in filling out forms can be put to better use working on machines.

**Fig. 3—Performance charts based on daily results present clear-cut picture of total plant output and operation**


K.W. GEN. PER GAL. DIESEL OIL K.W.
COMP. AIR MANUFACTURED 1,000 CUB. FT.
VACUUM PRODUCED 1,000 CUB. FT.
REFRIGERATION TONS
ICE MANUFACTURED 1,000 LBS.
REFRIGERATION FOR AIR CONDITIONING TONS
H.P. STEAM TO LAUNDRY 1,000 LBS.
CONDENSATE RETURNED FROM LAUNDRY 100 GALS.
TOTAL 240 VOLT K.W. TO LAUNDRY 100 K.W.

Cleanliness is the groundwork of maintenance in this plant. Equipment kept spotlessly clean stays in good operating condition because small defects or faults discovered during cleaning are repaired before they reach the danger point. Cleaning means more than just wiping off surface dust, it includes cleaning contactor fingers, wiping motor commutators and brushes, blowing out windings and checking for loose connections. Daily cleaning and visual inspection exposing weak points is the secret of low maintenance. Immediately after shutdown the shift foreman inspects the engines for loose parts such as connecting-rod bolts, piston-rod keys or nuts and checks adjustment of main and connecting-rod bearings. This inspection includes every part not accessible during operation and covers auxiliaries as well as main units.

### *Don't Delay Repairs*

Keep the plant in such shape that it could, if necessary, be operated in a pinch with greatly reduced force of experienced attendants forms the basis of the policy followed in the power plant. When unexpected breakdowns do occur, the shift foreman starts repairs immediately. If equipment fails during regular maintenance-crew working hours, or if it is a night emergency, men from that department assist with repairs. Otherwise the shift engineer finishes the work or turns the job over to his relief for completion. Immediate repairs eliminate any risk of causing a total plant failure. Even minor breakdowns are fixed before the next regular maintenance crews comes on the job.

The maintenance department takes care of all yearly inspection work in the power plant, together with all current building and equipment repairs. Both electrical and mechanical men, of the repair gang, report directly to the machine shop foreman who is responsible for carrying out all work orders. A handyman appointed to look after certain groups of buildings makes all repairs to minor apparatus such as leaking faucets, light switches, door locks and reports major troubles to the machine shop foreman. One man experienced in emergency work and elevator repairs reports for duty during night hours from 5 p.m. to 1a.m., always remaining within telephone call of the operator to be available for such emergency work as replacing blown lighting fuses or correcting a balky elevator.

Familiarizing each employee with all piping and wiring throughout the large hospital group is a major job in itself. Valve lists posted in each building show the service for each valve and give the area location. Numbers on the list correspond to similar numbers attached to the valves. In case of broken lines or other emergency a quick check on the list shows which valve to close, preventing delay and costly damage. Similar care is used on the electrical system; safety-switch and contactor-box markings agree with the individual machine designations, making identification easy for the mechanic.

### *Keep Only Useful Records*

Complete plant records pave the way for continued efficient operation. Costs figured on a close practical approximation of test conditions compare, in the same proportion and detail, one day's operation against another. Cost of supplies such as fuel oil, waste, feedwater chemicals and other items that last for several months are pro-rated over that

## POWER PLANT LOG

DATE Oct 30, 1942

| GENERATORS | | | | | COMPRESSED AIR | | REFRIGERATION | | | | | AIR CONDITIONING | | | | | | | | VACUUM | BUILDING HEATING | | | | | | DOMESTIC HOT WATER | | STEAM | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WATT METER READINGS — 240 VOLTS | | | | | COUNTER | | BRINE TEMP. | | COMPRESSOR COUNTER | | | BOOSTER HOURS | | | | | | | | PUMP COUNTER | HOT WATER SYSTEMS | | | | DIRECT | | | | | |
| POWER AND LIGHT | | | TOTAL | | | | | | | | | | | | | | | | | | PRIV PAV | | SEMI-PRIV | | PRESS OR VAC | | | | | |
| 2 | 3 | 4 | POWER | LIGHT | STEAM 1 | ELECT 2 | OUT | IN | STEAM 1 | ELECT 2 | TONS REFRIG. | ICE USED | ICE IN BOX | 1 | 2 | 3 | 4 | TURBO HOURS | MOTOR HOURS | COND PUMP COUNTER | CHILLED WATER TEMPERATURE OUT | CHILLED WATER TEMPERATURE IN | 1 | 2 | TEMP OUT | TEMP IN | TEMP OUT | TEMP IN | OUT | IN | OUTSIDE TEMP. | GALS BY VENTURI | TEMP | H.P. STEAM LAUNDRY | APARTMENTS |
| 305338 | 301977 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 301977 | 183741 | 642196 | 073577 | | 69015 | 17 | 21 | 393820 | | | | | | | | | | | | 140 | | 130 | | 3 | 6 | 52 | | 130 | 08018 | |
| 305356 | | 54 | 201 | 92 | | 714 | 17 | 21 | 7740 | | | | | | | | | | | | 136 | | 145 | | 3 | 6 | 56 | | 130 | 20 | |
| 75 | | 70 | 6 | 607 | | 70385 | 17 | 21 | 401180 | | | | | | | | | | | | 132 | | 150 | | 3 | 6 | 56 | | 130 | 4 | |
| 305675 | 302133 | 183809 | 642279 | 073838 | | 76542 | 16 | 20 | 475160 | | | 1700 | 4400 | | | | | | | | | | | 47670 | 112 | | 115 | | 5 | 6 | 56 | | 134 | 08048 | |

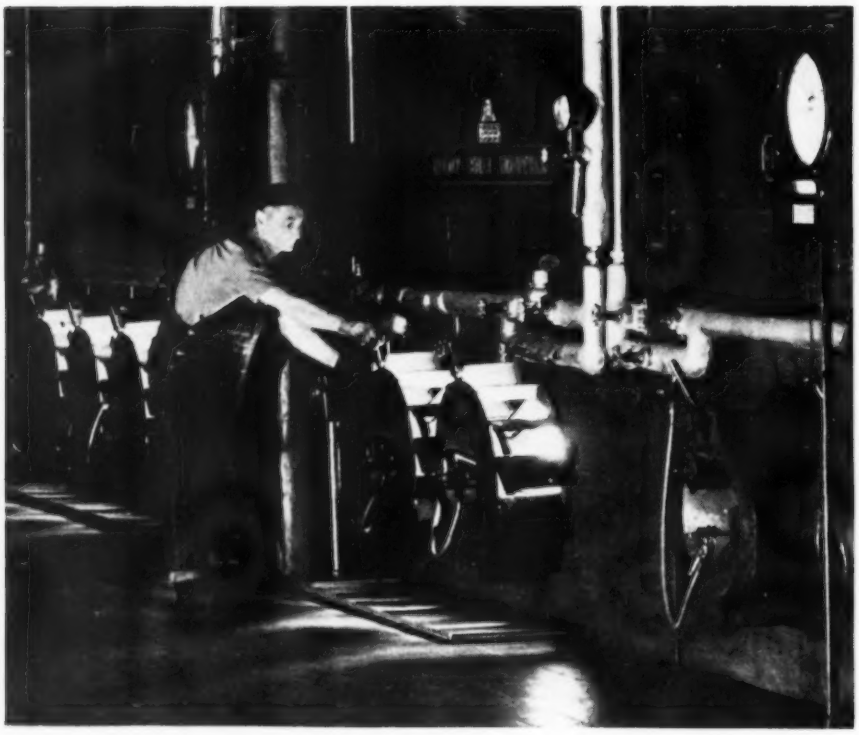
Boilers blown down and tubes cleaned.
Laundry steam off at 5:00 PM
#2 boiler off at 8 PM
#3 engine off at 10:30 PM
Cleaned tube cap plates #4 boiler

SIGNED

THIRD WATCH

Boilers blown down and tubes cleaned
Laundry steam on at 4 AM
#3 engine on at 6:30 AM
Off house steam on at 5:30 AM
#2 boiler on & #3 off at 4:30 AM

SIGNED



period rather than charged in a lump sum to one month. Adding to this the cost of repair material such as burner parts, boiler refractories and extra labor gives monthly operating expenses.

Water evaporation measured by an accurate venturi meter located in the main feedwater line gives the total monthly consumption. Individual boiler meters check one boiler's evaporation against another. Total operating cost divided by water evaporated gives steam cost per pound.

Computing steam cost for electrical generation requires that steam consumption of the reciprocating engines be known. Indicator cards taken under different load conditions and then analyzed gives steam consumption per kwhr. Watthour-meter readings multiplied by this constant shows the steam consumption. Cost of steam is then added to that of electrical supplies and repairs to find total generation cost. Total cost divided by kwhrs generated gives the cost per kwhr.

Tests on steam-driven auxiliaries supplied consumption constants for calculating daily power requirements. The number of pump or compressor strokes, registered on mechanical counters, multiplied by the constant gives steam use. Quantity of air or gas handled by the compressor is calculated from the counter reading.

Diesel cost figures, computed similar to those of the steam system, kept separately, permit comparing the two methods of operation. Performance graphs based on the foregoing consumption and output figures show plant operation from day to day and serve as a guard against unaccounted-for waste.

✦ ✦ ✦

# *Don't Fool With*
# "BAGGED" TUBES

***John M Gorrie, boiler inspector, looks at the "anatomy" of the tube bag, shows how it gets that way and makes some pointed remarks about "driving back" bagged tubes***

MODERN BOILERS come close to mechanical perfection but faulty water treatment, or complete lack of it, poor maintenance, forcing at high rates and other operating factors cause tubes to bag, blister, crack open or rupture. It is my intention to deal with just one of these troubles—the ordinary bag or bulge, which appears in many watertube boilers. I'd like to say a word or two on the relation between bagged tubes and plant safety, give some information on the "anatomy" of tube bulges, and point out a few things that cause bagged tubes.

At this time it is worth mentioning that several years ago—some say it happens still—some boiler-room foremen and engineers followed the practice of "driving" the bag back into the tube. This tube-wall straightening, resembling the driving back of a bagged sheet in a hot boiler, was accomplished by heating the tube to a dull red and using a hammer and a curved set of dimensions equal to the external diameter of the original tube.

Not so long ago, in a plant with eight cross-drum watertube boilers, the inspector walked into the boiler room to arrange for an inspection. The first thing he saw was a portable welding unit alongside the dead boiler. Rubber tubing from the oxygen and acetylene bottles passed through one of the setting inspection doors, from which came the sound of slow and heavy hammering and occasional grunts.

Neglectful of flyash and brickdust on his suit, the inspector pushed himself far enough through the door to see the boiler-room foreman and his crew at work. The foreman swung a short-handled 7-lb hammer while a helper held the cold set against a tube which had been heated with the torch. To cut a long story short, that tube, and three others, came out, amid much cussing. The torch *did* come in handy.

Although experts differ on the exact nature of tube bags, no one questions the fact that they weaken a tube and thus, in effect, lower the safe working pressure of the boiler. In dealing with

bagged tubes, the engineer can safely paraphrase New York's dimout slogan "If in doubt, cut it out!" Trying to drive bulges back into shape is just plain bad practice.

At the present time there are not enough data concerning bagged tubes from a practical standpoint. However, the general theory of what happens to the tube wall when the tube bags runs about as follows: The metal thins out because of plastic flow, causing a longitudinal thinning of the tube wall as well as circumferential thinning, and in overheating the metal loses its strength, permitting the internal pressure to form the bulge.

But we know from actual experience in power plants in this country and elsewhere that bags or bulges form which do not come about through the thinning of the tube wall in all directions. We have seen "pinpoint" bags which may have been caused by anything from a ⅜-in. nut to ordinary scale or other impurities.

### *Bagged Tubes Measured*

One boiler inspector got a bee in his bonnet and started collecting sections of bagged tubes. His procedure was to cut the tube away from the bag, thus procuring sections of various lengths, from 5 to 8 in., with the bag in the middle. At home he would cut the bag through the crown. This often took three or more hacksaw blades and on several occasions it was necessary to use a machine saw to cut through the crown of the bag. This proved that the crown was brittle and hard. Out of roughly 200 bagged sections cut by this inspector, only one had what might be termed a "soft bag" in that the metal seemed like lead and could be tapped back into the tube easily.

The next step in this experiment involved putting a micrometer on the walls of the tube sections cut. The age of the tubes was also recorded. It was found that the metal forming the crown was thicker than the tube sides while the back of the tube was always found thickest. It should be remembered that the bags or bulges under discussion were all of the large plain type.

To take one example, consider a tube which became badly bagged after eight months service. The tube was removed and the bagged section cut out. The crown of the bag was sawed through in the manner described and the metal thicknesses measured. The tube was a 9-gage 3½-in. OD when new and should have "miked" 0.148 in. wall thickness. The actual micrometer readings were: crown of bag, after cleaning—0.140 in.; side walls—0.120 and 0.137 in.; back of tube, or side opposite bulge—0.145 in.

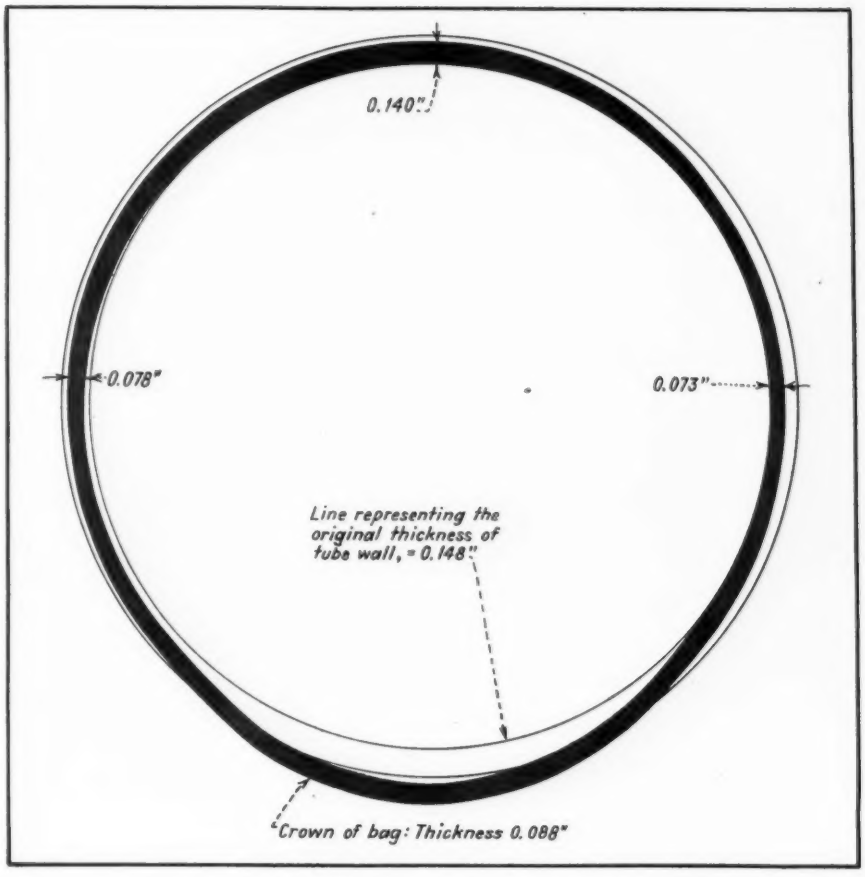



**Diagram illustrates section through bagged part of tube, with micrometer readings of wall thickness at important points; light circles show original tube outline**

Another example, a tube which had 10 years service in a boiler, is shown in the sketch. Here again the pattern was the same; back of tube thickest, crown of bag next and sides thinnest. The deflection of the tube caused by the bag was measured as 0.171 in. This last reading as to the depth of the bag is not much but the fact that the crown of the bag was blistered made renewal of the tube imperative. Using the ASME Code formula, this tube, reduced in thickness as it was, stacked up as good for only 150 psi working pressure. The allowable pressure on the boiler was 200 psi and actual operation was at 175 psi. It should be apparent that safety is a more desirable factor in boiler-plant operation than the kind of economy that tries to see how long a tube can be made to last.

Tube bagging results from local overheating. This is often caused by scale and such a condition can be detected readily by examination of the bagged section cut from the tube. What is often puzzling is to find a bag occurring in a clean tube. Recent investigations blame "steam blanketing" as the cause of many tube failures.

Under certain conditions of unstable circulation, minute steam bubbles adhere to the internal tube-wall surfaces and attract larger bubbles, which join together, sometimes covering several square inches of tube surface. The steam bubbles tend to become streamlined, permitting the circulating water to flow over the steam surface.

This condition prevents the intimate contact between cooling water and tube metal necessary to preserve the metal structure. Overheating follows with the inevitable consequences. Steam blanketing seems to occur usually at high ratings which indicates that two possible cures exist—to operate at lower ratings or to improve circulation conditions by design changes.

Tube failures seldom occur because of inferior workmanship, either in forming the tube or in placing the tube in the boiler. Circulation difficulties cause some failures and scale probably more. Poor maintenance causes many bagged tubes. The important things for the operating engineer to remember are: (1) bagged tubes represent danger spots—cut them out, and (2) bagged tubes don't just get that way, something causes them—find out where the trouble is, whether maintenance, water treatment or boiler design, and take steps to cure it immediately.

# PRACTICAL AIDS TO OPERATION

*General Electric photo*

## Flyash Blast Cleans Metal Surfaces

MANY INDUSTRIAL-MAINTENANCE and product-finishing jobs involve the removal of scale or other hard substances from complex surfaces. Sandblasting is ideal for many of these jobs, but in others sand may be objectionable because it is highly abrasive, scores and roughens the surface of the metal cleaned and cuts metal rapidly.

Recent investigations have pointed to the use of flyash taken from the bases of smokestacks serving pulverized-fuel-fired boilers as a substitute for sand where metal losses must be held at a minimum. Particles of this material will practically all pass through a 200-mesh screen, are reasonably hard, are rounded rather than sharp and can be easily handled in the blast gun. In addition, it is available in almost unlimited quantities at practically no cost, wherever pulverized coal is burned.

Experience in the removal of hard-silica scale from large steam-turbine blades has demonstrated that flyash does a thorough job in less than half the time required with hand tools. To verify the expectation that metal loss is low blades weighed before and after cleaning showed practically no change in weight. Similar results have been obtained in a large manufacturing plant when using flyash in a blast gun to clean small metal parts on a production line.

*Stanton, Va.* S H COLEMAN

## Pointers on Keeping Compressed Air Clean

"KEEP THE AIR CLEAN", could well be the slogan of every engineer that operates compressed-air systems. Locating the compressor in any old place and then subjecting it to carelessness and neglect is an all too common practice. Air compressors can take it on the chin for long periods, without "calling quits," but this is no reason for neglecting them.

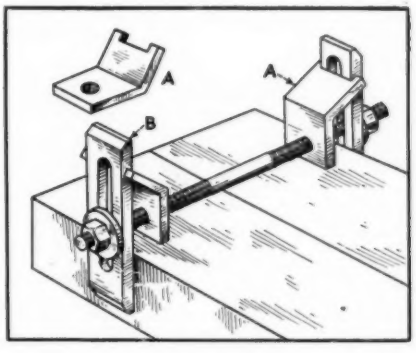
Supply the compressor intake with clean air. Damaged screens and filters or those that have outlived their usefulness, have no place on the end of an intake pipe or connection. But one sees plenty of intakes with rusted, broken, or clogged screens, and with their interior in a horrible condition. Don't locate the intakes of compressors where the air contains dust, dirt, soot and grit, as is sometimes done. On the delivery end, compressors are too frequently given large doses of neglect in layout, care, and maintenance. Filters and traps are often used miserly, or have been forgotten after being installed.

Valves, and other mechanisms of many tools operated by compressed air, are made with extremely close tolerances to make them function properly. These tools will last a long time and can take a lot of punishment, if properly cared for and lubricated. However, for the lubricant to be effective, proper filters and drainage must be provided on the air lines and the lines must be blown out periodically.

Compressed air is generally used for blowing and cleaning parts and assemblies during various manufacturing operations, sometimes on delicate mechanisms such as watch assemblies, precision instruments, etc. When we attempt to blow out dirt and dust, from gage, watch and instrument parts during manufacturing operations, let's be sure not to blow in more harmful particles than are being blown out.

*Fanwood, N. J.* D F MOYNIHAN

*From a paper submitted in the Compressed Air in Industry contest sponsored by the Compressed Air Institute.*



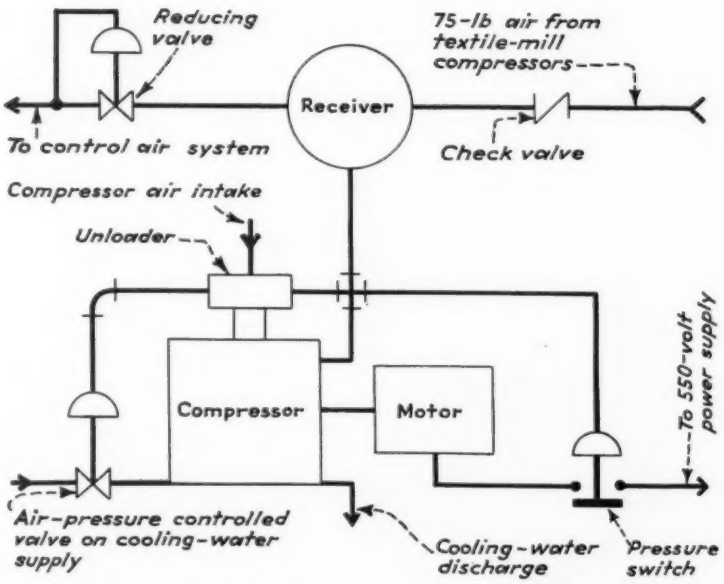

## Clamp Sized to Needs

IN OUR SHOP we do all kinds of jobs for both the power house and mill. Some of these jobs require clamps with a wide span and I proceeded to make two of the design shown in the figure.

They consist of long rods threaded for most of their length, a couple of slotted machine straps *B* and two ratchet lugs *A* threaded onto the rods to support the top end of the clamps. These clamps are handy for work beyond the range of the ordinary shop designs and in our shop are very useful tools.

*Penacook, N. H.* CHAS H WILLEY

## Dual Air Supply for Control Operation




COMPRESSED AIR for controls in our power plant is normally supplied from the 75-lb compressed-air system in the textile mill. This supply may be interrupted over weekends, so we have a small compressor in the power plant connected into the air system, as in the diagram. This compressor is started by the pressure switch closing when air pressure drops to 48 lb. Air pressure, however, holds the unloader closed until the pressure drops to 45 lb, so that the motor does not have to start the compressor loaded.

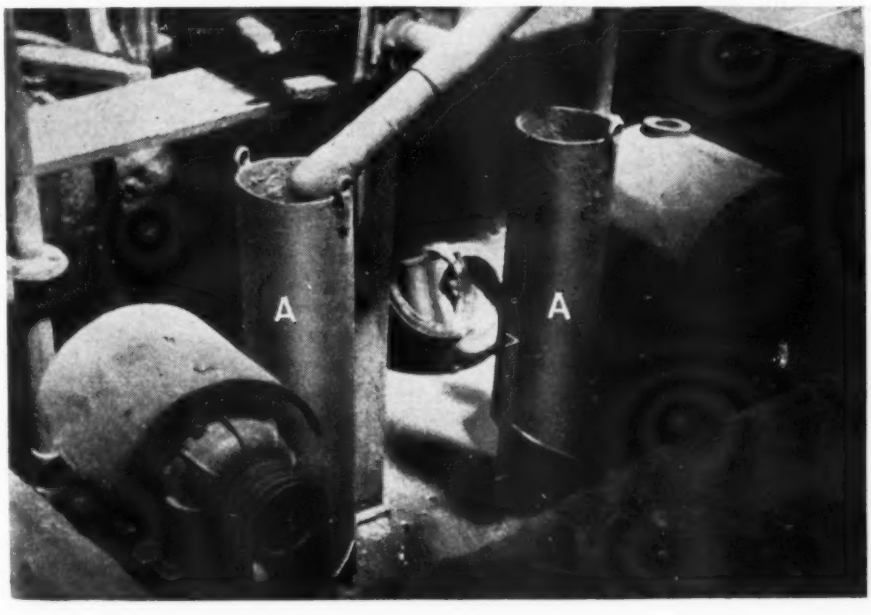
Cooling water is turned on for the compressor by the unloader when it opens. The compressor operates automatically to hold the air pressure between 60 and 45 lb. When the 75-lb compressors are started in the textile mill and the pressure reaches 60 lb, the pressure switch on the small compressor cuts the unit out of service and it cannot be started again until the pressure drops to 48 lb. This system works satisfactorily and automatically insures an air supply for our power-house control equipment, without duplicating the small compressor.

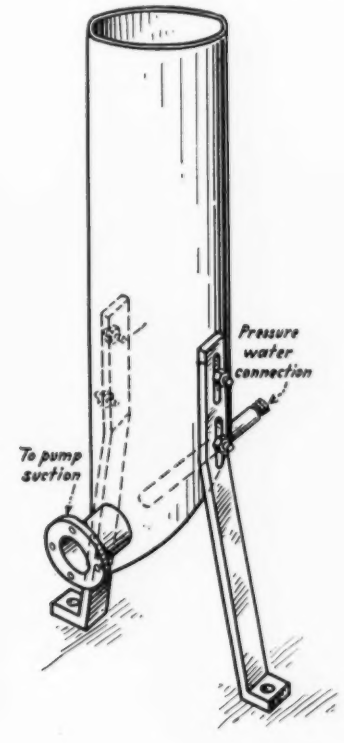
*Lancaster, S. C.* WALTER C KING

# Small-Volume Sump Improves Pump Operation

WE HAD DIFFICULTY pumping deslimed table sand from a conventional sump and solved the problem with sumps of a design shown in the drawing and at *A* in the photo. The sumps were made from lengths of large scrap pipe cut at an angle of 45 deg at the bottom end and closed by welding in a ¼-in steel plate. We also welded a flanged nipple 6 in. long near the lowest point of the sump, for connection to the pump suction. In the sloping bottom opposite the suction nipple we welded a connection for a high-pressure water line to supply water directly into the pump intake. Legs, made from ½x2-in. steel bars were fastened to the side of the sump by two short threaded studs welded to the pipe. Slots in the legs permit adjusting the position of the sump connection to the height of the pump suction.

The size of the sump can be varied to

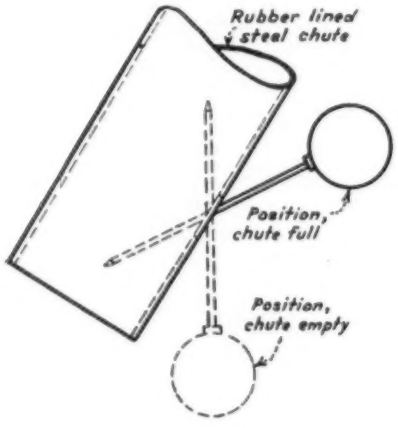


suit the size of pump. I have found that a 6-in. pipe 6 ft long makes a suitable sump for a 2-in. pump handling heavy pyrite concentrate, but a larger pipe is preferred. It is advisable to have the sump depth not less than 4 ft because the pump used requires a suction head of not less than 3 ft for good operation. Every engineer knows how important correct suction conditions are on any pump and on these the requirement are even more rigid.

Its small volume is one of the advantages for this sump. If the pump has a tendency to shirk the load, the sump immediately fills, increasing the suction head on the pump, and causing it to resume pumping. The small volume also reduces the tendency of the pump to surge, by shortening the surge cycle. Several compact combinations of dual pump arrangements can be made with this sump, which in close quarters will save space and facilitate repairs, both important items in our operations.

*La Paz, Brazil* N L DOTSON, JR




## Simple Low-Coal Signal Device

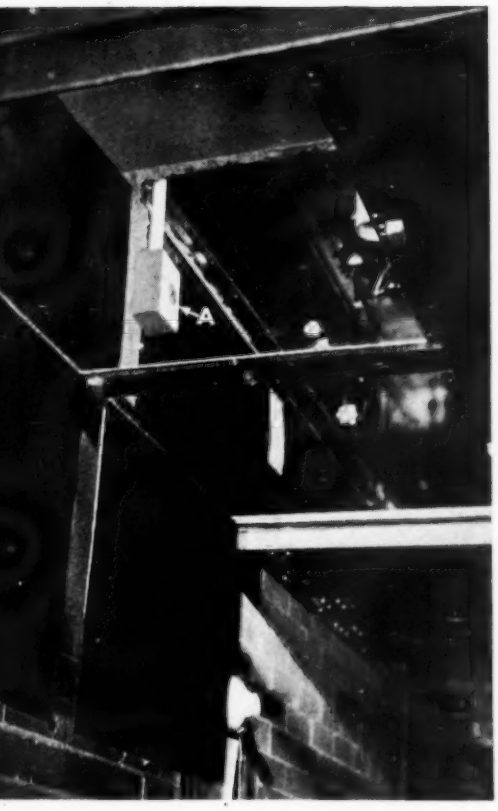
A NUMBER OF DEVICES are available to give a signal or an alarm when coal level in a stoker hopper drops too low. A simple and easy one to build is shown in the diagram, and has been used successfully for several years. This device was originally applied to rubber-lined steel chutes. The signal consists of a pointed round metal rod with a hollow ball on the blunt end to serve as an indicator.

To install it we cut a small slot in the chute, pushed the pointed rod through the rubber and painted the ball with aluminum paint so that it could be seen easily. As long as coal remains in the chute the ball is held in the up position, shown in full lines. If coal fails to come down the chute, the ball drops to the position shown in dotted lines.

Although we did not do so, it would be easy to attach a mercury switch to the rod to give an alarm when the ball drops. In time the rod may wear and require replacing.

When the signal is applied to plain steel chutes or hoppers, cut a small hole in the steel wall and bolt a rubber pad over it. Push the rod through the rubber as described above and the signal is ready for operation as a coal-flow indicator.

*Hartford, England* B M THORNTON

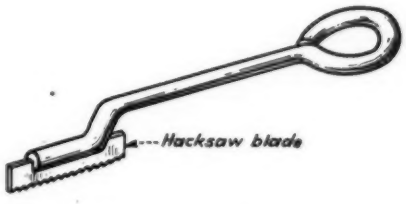



## Hinged Covers for Cable Enclosures

COVERS FOR THE CABLE and conduit enclosures above switch and signal boards are frequently fastened in place with screws. When taking those screws out to remove the covers there is always danger of them or the cover falling on live parts and causing short circuits. On the air-conditioning-system signal board in the new home office building of the Metropolitan Life Insurance Co, New York City the covers for the cable enclosure are hinged on one side, so that they can swing down, as in the photo. When the covers are swung up in place they are held by spring catches. To open a cover only one spring catch has to be released. This entirely eliminates the removal of screws or the use of tool to open or close the covers.

Another feature of this cable enclosure is a plug-in outlet provided at *A* for the use of an extension light or operation of portable tools and a source of direct current for testing. This outlet is in addition to the permanent lighting installed in the enclosure and permits getting light conveniently into dark corners when needed.

FIELD EDITOR




## Undercutting Mica Cures Excitation Trouble

ABOUT TWELVE YEARS AGO we installed a small direct-current lighting generator, which operated satisfactorily for five years and then gave trouble by failing to build up its voltage when

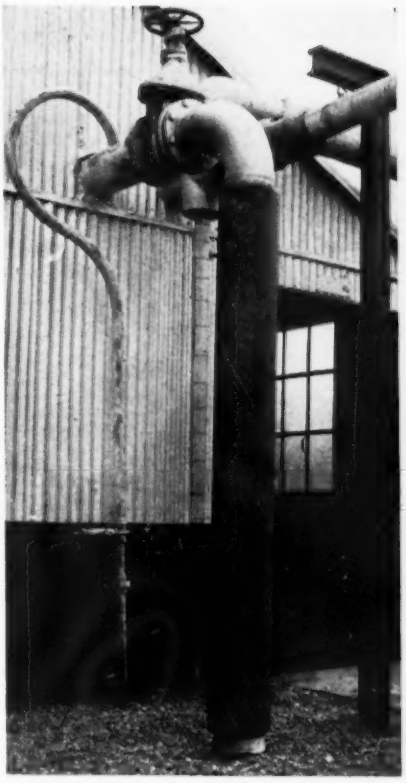
started. An electrical troubleshooter was called in and corrected the fault by undercutting the commutator mica. Recently the old trouble returned so I did the mica undercutting myself. To do the job I made the tool, shown in the diagram, from a piece of round steel and a section of hacksaw blade.

After shaping the rod to the form shown I slotted its offset end and inserted the hacksaw section. Squeezing the two sides of the slot in a heavy vise secured the hacksaw blade in the slot. The set of the teeth was too wide for the mica thickness, so I ground them down so that they would clear the commutator bars when cutting the mica. With this tool the job was easily done and the machine made ready for service in a short time when it was badly needed.

*Vancouver, B. C.* R MANLEY ORR

## Insulation Eliminates Accident Hazard

INSULATION IS GENERALLY put on hot pipes to prevent heat loss. However, in one plant it was used to keep employees from being burned accidentally. All steam-using equipment exhausted into a common header that led to an air-cooled radiator-type condenser. More heat lost in the exhaust line meant less to be dissipated in the condenser; consequently the line was left bare. A vertical section of this line came down from overhead into the ground near a door frequented by employees. To eliminate the hot pipe as an accident hazard it was insulated as in the photo.



*Santa Monica, Calif.*

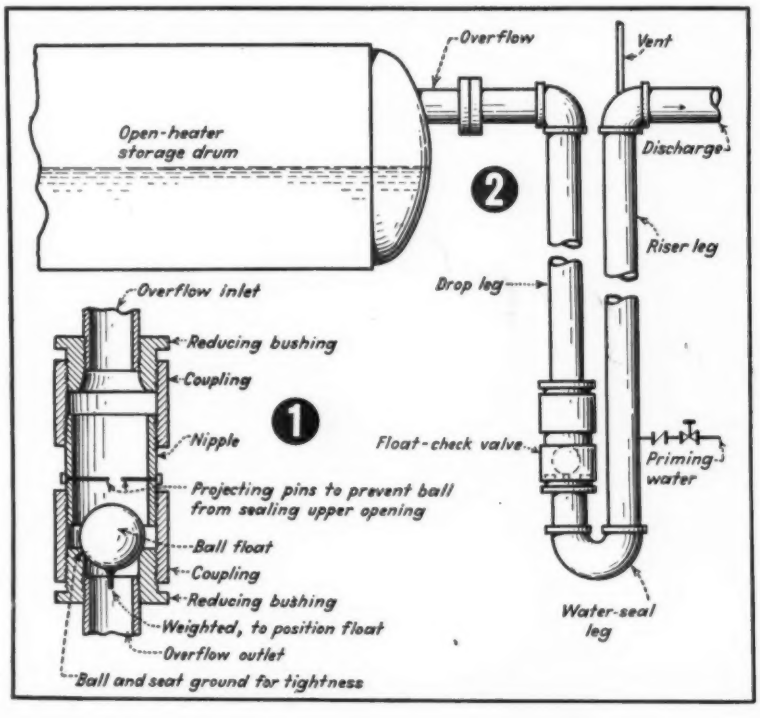
JOHN C ALBRIGHT

## Seals Heater Overflow With Ball Float

FOR MANUFACTURING REASONS we had to increase the backpressure on our open feedwater heater from 3 to 8 psi. When the pressure was raised we could not maintain the seal on the overflow because the leg was not long enough. The heater could not be raised without going through the roof and the leg could not be extended downward without digging up the boiler-room floor. We therefore built the float check valve, Fig. 1, from pipe fittings and the float from a high-pressure steam trap, and connected it in the overflow seal as in Fig. 2. A better device could probably be made from an old vertical ball check valve in which the weighted ball would be replaced with a float of the same size, but we did not have the check valve handy.

Steam pressure in the drop leg of the seal being greater than the static head in the riser leg holds the float to its seat and prevents the sealing water being blown out. If the heater overflows and submerges the float, its buoyance, plus the static head from the riser, causes the float to rise and steam pressure forces the water out. When overflow ceases the float goes back to its seat and retains the water in the seal.

*Melrose, Mass.* E MACDERMOD




## Some Precautions When Fixing Foundation Bolts

GROUT FOR FIXING foundation bolts must be thin and free flowing. For this work I have found that a mixture of three parts of sand and one of cement, mixed with sufficient water to flow freely, is satisfactory. The addition of a small amount of soda to the water will increase the hardness of the grout when set.

When lead is used to fix the bolts in their holes, it must be hot enough to flow freely to all parts of hole before congealing. Make sure that the lead ladle has sufficient capacity to fill one hole at a single pouring. Also make sure that the bolts and holes are perfectly dry before pouring in the lead, for only a small amount of moisture will cause a lead explosion. It is advisable to heat the bolts by playing a blow torch flame down upon them before pouring in the lead to prevent chilling it.

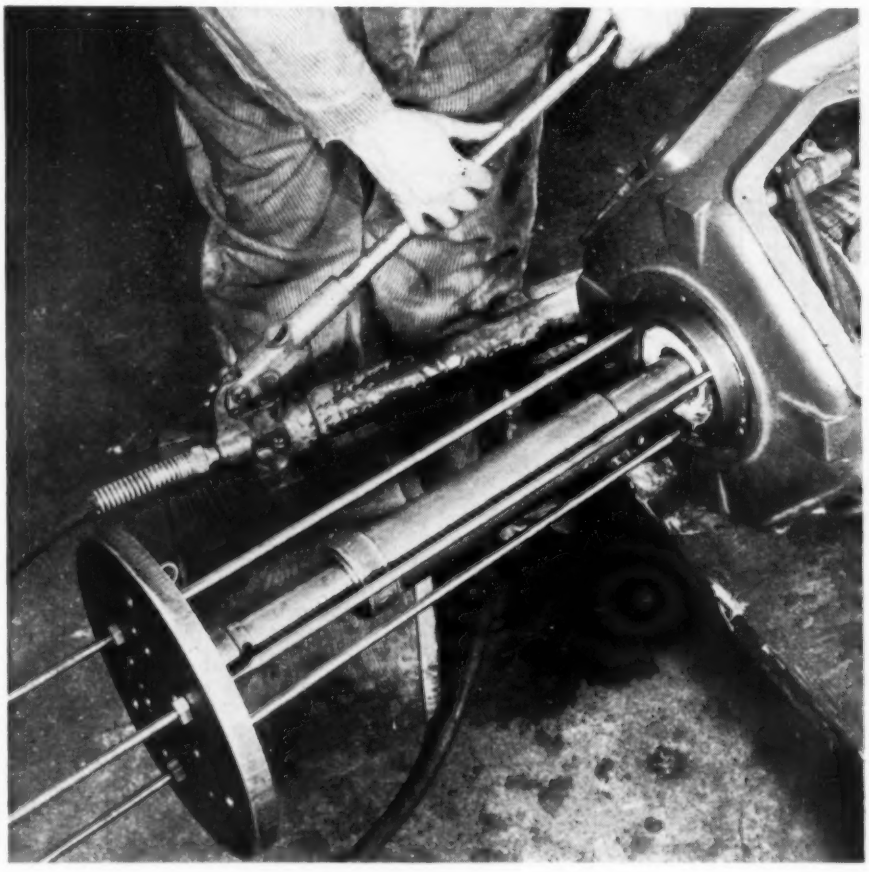
*Woodford, England* W E WARNER

# HOW TO REMOVE ANTI-FRICTION BEARINGS

MAINTENANCE MEN who know how easily a motor with sleeve bearings can be dismantled may get a surprise when they, for the first time, attempt to take the rotor out of one equipped with anti-friction bearings. These bearings are mounted in different ways in the motor end bells and may require different handling to remove them. In practically all applications the outer race makes a fairly snug fit in the motor end bell and the inner race a similar fit on the motor shaft. Therefore, some form of puller to remove the bearing from the shaft is essential. The method of applying the puller depends on how the bearings are mounted in the end bells. The photographs, by courtesy of the General Electric Co, show how one design of ball bearing is removed. In this design each bearing fits snugly into a housing which in turn goes into a circular recess in the end bell on the motor frame.

**1** With a heavy screw driver remove the screws that hold the bearing-cap ring locking plate in place. Then remove ring locking plate and small countersunk screws fastening the bearing cap

**2** Remove the cap to expose the bearing. The bearing shown entirely covered with grease fits into its housing *A* recessed into the motor end bell



**3** This housing has three threaded holes, 120 deg apart, used to pull the housing and bearing out as a unit. Thread three ⅜-in. pulling rods into the bearing housing and put a flat circular plate with holes in it on them, held in place by nuts on the rods. On this puller the plate has several holes bored in it to accommodate various arrangements and sizes of pulling rods for different bearing designs. Place a hydraulic jack between motor shaft and plate and pull out the housing and bearing. The photo shows the housing with the bearing partly pulled out of its recess in the end bell

Photographs and material for "How to Take Care of Rubber Gloves," (POWER, Dec. 1942, pg 119), were supplied by B F Goodrich Co.

**4** If bearing cannot be pulled out of housing with the hand, face the housing down on a bench. Move the grease seal *S* to one side to expose the bearing race as at *R*. Tapping lightly on the race makes the bearing move easily out of the housing. Do not tap on the grease seal *S*. If the bearing is not going back into the motor immediately, leave it in the housing, wrap and tie the assembly in a clean cloth and let it remain until needed. Then remove the bearing from the housing and thoroughly clean before putting into the motor. After the bearing has been cleaned be careful to keep it clean, even handling it with clean hands. A small amount of grit in an anti-friction bearing may cause serious damage to its highly polished surfaces

**5** To assemble the bearing, first put the bearing housing in place. The shaft comes through the back of the housing with only small clearance so that when the housing is in place the shaft practically centers for the bearing. With the housing seated, next put the grease seal *S* in place

**6** After entering the bearing in the housing and on the shaft, if it does not slide home when pushed with the hand, tap lightly with a hammer on a piece of fiber or hard wood held against the inner and outer races. When the bearing seats properly, put on the cap and with a grease gun fill the bearing with correct quality grease. Before starting the motor remove the drain plug from the bearing cap. Start the motor and let it run for a few minutes to permit the bearing to pump out all excess grease. Replace and tighten the drain plug and the bearing is then ready for service

# READERS' PROBLEMS

## *Questions from Our Readers*

### Air Compressor Protection

#### *Question 1*

WE HAVE RECENTLY *installed a complete compressed-air system in our plant. Two-stage 250-psi compressors start, load, unload and stop automatically by pressure control. Lacking complete knowledge on the operation and care of air compressors and having heard of the dangerous possibilities of compressed-air explosions I would appreciate suggestions from* POWER *readers on protection against this hazard. Is there any device which can be made in the plant shop that will shut the machine down on high air temperature? Could a suitable thermostat be attached to the discharge pipe and wired into the motor control circuit or should we use a flow switch in the cooling water piping?*—BVN

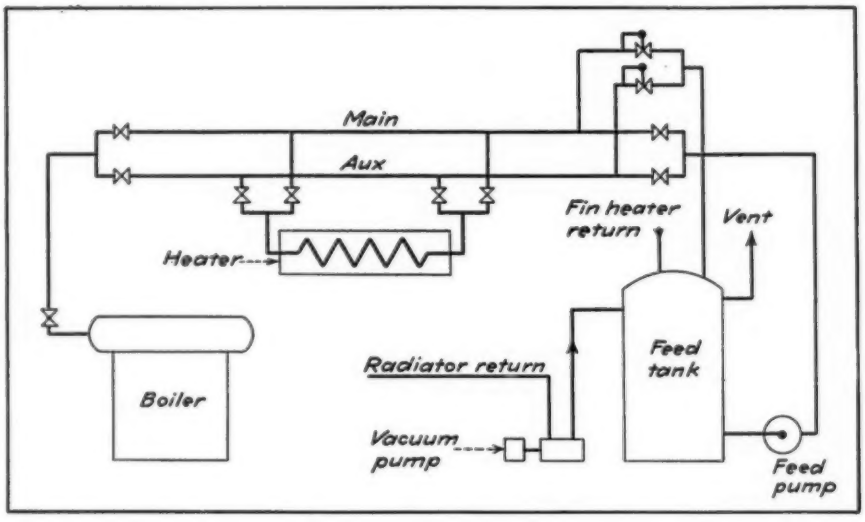
### Can Oxygen Be Removed?

#### *Question 2*

WE HAVE TWO *100-hp boilers for heating our office and shops. Steam is generated at 100 psi and supplied to fin heaters. Condensate from these heaters returns direct to the feedwater tank. Boiler pressure steam reduced to 10 psi feeds all office building radiators. Condensate from radiators is returned to the feedwater tank by a vacuum pump. A float-operated valve in the raw-water makeup line controls water level in the feedwater tank. Fuel oil heater condensate is discharged to waste. This loss, together with feedwater-tank vent loss, requires approximately 10% makeup from raw water.*

*Boiler-feed pumps take water from the feed tank and pass it through a closed heater and then to the boilers. Two boiler-feed lines are installed between the feed pumps and boilers, each line fitted with a pressure-regulating valve discharging to feedwater tank.*

*When the boilers were first installed we had considerable scale formation. This trouble was soon corrected by adding periodic chemical doses to the feedwater. Our present trouble appears as corrosion of the steaming tubes. Tests have shown that our makeup water contains considerable quantities of oxygen. By circulating the feedwater through the heater and back to feed tank we have been able to reduce the oxygen content to the recommended minimum. This worked satisfactorily until we began shutting the boilers down over night to conserve oil. Partial cooling of the water in the feed tank caused a heavy absorption of oxygen through the feed-tank vent line.*




*It is impossible to install a deaerating heater and we do not care to add large amounts of chemical to react with the oxygen. Could we pipe all condensate direct to the tank and use the vacuum pump to maintain a negative pressure inside or would vaporization of the 180-F water cause excessive loss? What other methods could we use?*—WFF

### What Causes Burn Spots?

#### *Answers to Nov Question 1*

#### *The Question*

THE COMMUTATOR *on a 25-hp 6-pole 70-rpm dc shunt-wound elevator motor contains six equally distributed burn spots corresponding to the brush spacing. Each burn covers an area of four commutator bars and begins to appear a few days after resurfacing the commutator.*

*This trouble has been continuous since a few coils were replaced several years ago. Feeling that the cause might lay in these coils I checked them repeatedly without finding any trouble.*

*When the elevator ascends no sparking appears, but slight sparking occurs when it lowers. Slightly greater sparking occurs during starting and stopping. There are several of these machines in service and, although sparking on the others is more severe, this is the only motor that shows definite spaced burns on the commutator. What can be causing this trouble when it does not appear on the other motors?*—ENC

### Trouble Probably Lies In Armature Winding

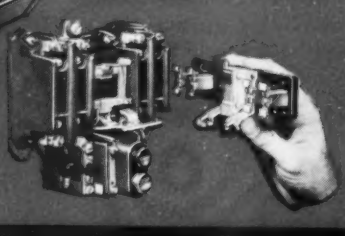
POSSIBLE CAUSES of sparking, flashing at the brushes, or blackened commutator, the last of which appears to be ENC's difficulty, are: Rough commutator, high or low bars on commutator, high mica, brushes too short, insufficient brush tension or weak brush springs, brushes sticking in holders, dirt or oil contamination, shorted armature winding, open armature winding, misalignment and excessive moisture.

Of course, each of the above named causes should be suspected and the necessary cure carried out. Evidently resurfacing of the commutator failed to effect a permanent cure. This in itself would tend to correct some of the causes listed above. Therefore we are inclined to feel that the difficulty is not caused by a local derangement in the commutator itself. We would suspect trouble in the armature winding. Armature winding troubles generally result from the following: (a) A broken coil lead caused by the wire connection

(*Continued on page* 124)

# KEEP 'EM CLEAN TO KEEP 'EM WORKING

You don't have to argue with a man up at the front that it's just good sense to keep guns clean to keep 'em working. Nor do you have to argue with experienced men on the front line of production that the same thing holds true for motor control. Of course you *have to* keep motor control contacts clean . . . but *how* are you going to do it? Why make an *extra* maintenance chore of it—especially when men are so scarce? Specify Cutler-Hammer Motor Control with the VERTICAL *dust-safe* contacts that *shed* dirt and *keep themselves clean.* That's the direct way of insuring unfailing motor control performance . . . and there's no extra cost. CUTLER-HAMMER, Inc., 1358 St. Paul Avenue, Milwaukee, Wisconsin. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto, Ont.



CUTLER-HAMMER
MOTOR CONTROL
C-H

## Cutler-Hammer Vertical Contacts

**OUT IN THE OPEN—NOTHING TO HIDE**—You can see the clean contacts in Cutler-Hammer Motor Control as soon as you open the case. They're out in the open where they can work cooler and last longer.

Copyright 1943, Cutler-Hammer, Inc.

to the commutator being too tight, excessive vibration, poor soldering at the commutator neck, or the use of copper which was not properly annealed. This results in a bad arc at the instant the brush breaks contact with the segment connected to the broken coil. (b) A short-circuited armature coil, and (c) a reversed armature coil.

ENC states that a few coils were replaced several years ago, and the trouble has been continuous ever since. This leads to the deduction that one or more of these armature coils were inadvertently reversed during the repairs. Inasmuch as the electromotive force of the reversed coil or coils opposes that of the other coils, that circuit, or circuits, in the armature generates less than normal voltage.

At the moment of commutation, the conductors of this coil or coils will be under the wrong pole tips and local sparking will take place. The fact that the motor is of the 6-pole design, and burn spots are located at six equally distributed spots on the commutator (corresponding, of course, to brush spacing) would indicate that this commutator burning occurs as a result of the reversed coil coming under the wrong pole tip at the instant of commutation, the six equidistant burn spots being the result of the reversed coil or coils coming under the wrong pole tip six times in the course of each revolution, and being equally spaced because of the symmetrical location of the poles in the motor field construction. Therefore before checking the various other causes suggested above we recommend that a thorough check be made of the armature for reversed coils.

*Cleveland, Ohio* A R Ciotti

## Check Resistors And Connections

The brush trouble described by ENC could be caused by any one of several faults. Since the trouble occurs only in one direction of rotation the trouble probably lies in a delayed field current supply in the down motion.

There are many places to look for the trouble and I suggest that he check field circuit resistor tubes, directional switches, acceleration switches, and contact switch clearances, including all connections.

However, it would be more advisable and practical for ENC to consult a reliable elevator firm which is thoroughly conversant with the electrical end of elevators.

Carl Bachmann

*Schenectady, N. Y.*

## Excessive Friction

Since ENC has checked the armature for electrical faults the trouble is likely mechanical. The brush position should be carefully checked and altered as necessary to reduce sparking to the minimum. Apparently friction in the system somewhere makes the armature stop in the same position and provide an abnormal starting load which the brush system cannot carry without commutator damage. Such a fault may be in the brake, speed reducer, or running gear. A recording strip chart ammeter, with a fast chart speed, connected in the motor circuit will help in locating the cause of the trouble. Worn motor bearings and lack of perfect armature balance may be affecting point at which armature comes to rest.

*St John, N.B.* C G Clark

## Requires New Commutator Mica

The description submitted by ENC indicates that the trouble is caused by a high-resistance ground in the armature. The trouble, having been continuous since a few coils were replaced some time ago, shows that the coil replacement was only part of the remedy and that the present trouble results from the previous condition.

The insulating mica between the commutator bars may have broken down and if this is case the commutator must be taken apart and new mica fitted. Check the elevator shaft and rails for possible misalignment.

Transfer this motor to another elevator in exchange for one in good condition as a test whether the trouble is entirely in the motor or elsewhere. There may be a defect in the contacts or the potential switches on the board.

*Kearny, N. J.* George McNally

## Check Impedance of New Coils

There are at least two probable reasons for the trouble ENC encounters with his motor. The first of these concerns resurfacing of the commutator. It is essential to dress the commutator until there is no trace of a burn left. Any sparking at a partially dressed spot will gradually increase, where it might not burn if the commutator had been completely cleaned.

A second cause can be traced to the replaced coils. The trouble started soon after the coils were replaced and perhaps one of these is giving the trouble. ENC states that he has checked the coils with this in mind and we assume that he has made a megger and resistance test. A resistance test would not be accurate enough to check the number of turns in the new coils against the number in the old coils, nor would a small difference be apparent to the eye if a mistake had been made in counting the number of turns. The fact that the number of turns on a replaced coil is different than the number on the other coils means that the inductance of the new coil will be different and will unquestionably lead to faulty commutation and sparking. The motor is probably a wave-wound machine, which means that the six brushes will be in two sets of three each and the two sets will be connected in parallel. Thus, sparking at any one brush will cause sparking at all of them. Not only will the sparking occur at all the brushes, but because of the different inductance of the one coil sparking will occur when the commutator is in one position. We therefore have the worst sparking occurring time after time at the same six points (corresponding to the brush positions).

ENC should check the new coils against the old coils by connecting them to an ac source—60-cycle will do—and accurately measuring the impedance of the new coils and checking it against that of the old coils. This will be a more accurate check on the number of turns per coil than a resistance test and will most likely bring to light the faulty coil which can be replaced.

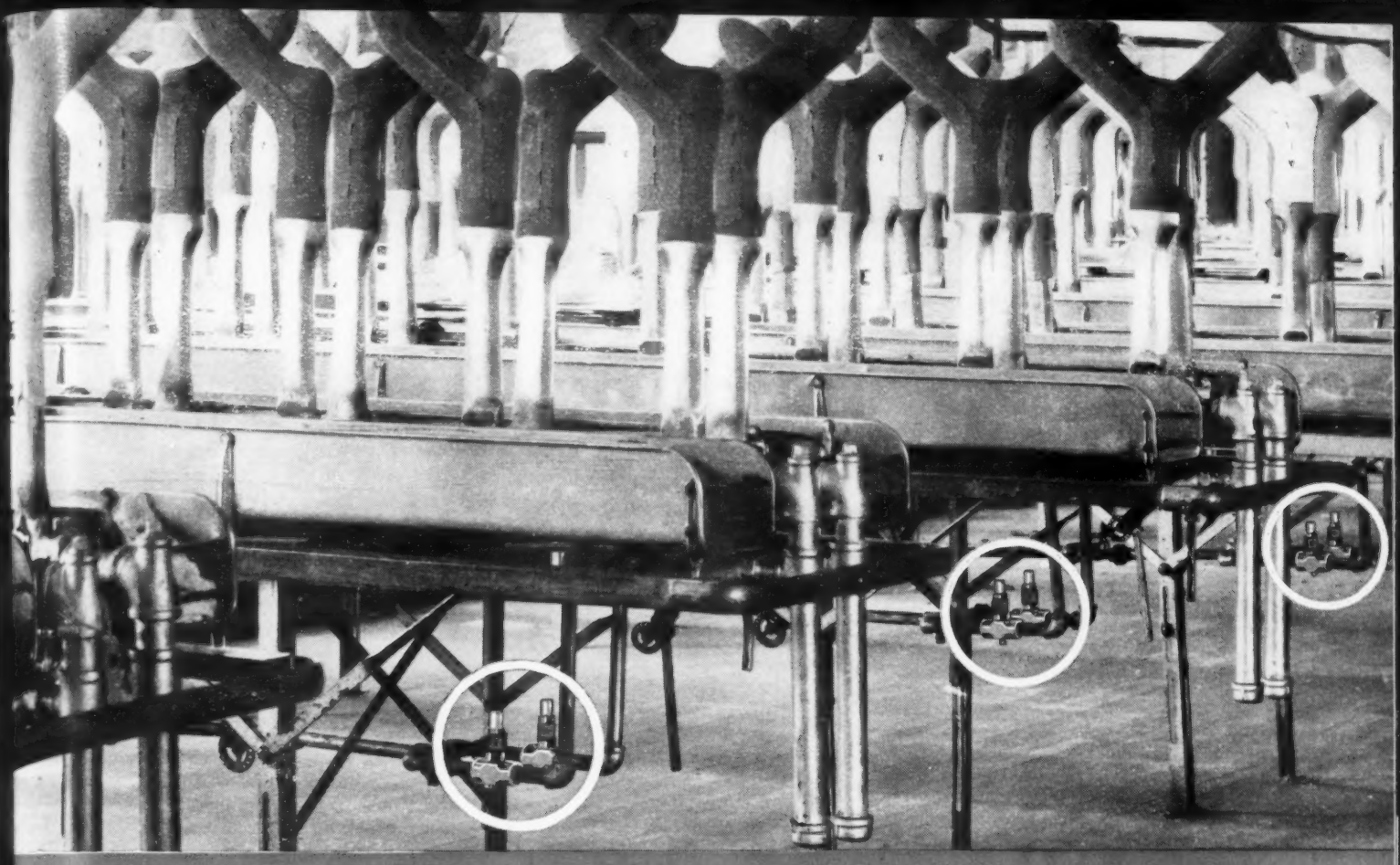
The other motors are not burning because they are sparking at different positions of the commutator and not repeatedly at the same position, which does the real damage. Dynamic braking occurs when the elevator descends, causing more sparking.

*Brooklyn, N. Y.* K E Blessing

## Measure Voltage at Each Brush

As the elevator motor in ENC's question sparks less while rotating in one direction compared with the other direction, the sparking could be equalized so as to be approximately the same

(*Continued on page* 126)



# "Better Than Any Other Steam Trap I Have Ever Used"...

**Says H. P. Tucker, Superintendent of Maintenance, Whisnant Hosiery Mills, Hickory, N. C.**

"I LIKE the Yarway Impulse Trap better than any other I have ever used. They have been in service on our stocking drying forms for over 2 years and have not required any maintenance," Mr. Tucker reports.

This is the kind of dependable, efficient, trouble-free service that has sold more than 180,000 Yarway Impulse Traps throughout Industry.

Install a Yarway Impulse Trap or two and let them demonstrate what they can do for you in *speeding production* and *saving fuel.* See how its *small size saves space.* How its *light weight simplifies installation.* How its unique design with *only one moving part,* and its rugged *bar-stock construction,* practically *eliminate maintenance expense.* Then too, Yarway Traps are *suitable for varying pressures without change of valve or seat.* And when you consider that their *purchase price* is usually *no more than the cost of repairing an ordinary trap*—why not get Yarway performance for your money?

A nearby Mill Supply Dealer handles them and will be glad to serve you. Or write for Bulletin T-1737.

**YARNALL-WARING COMPANY,** 100 Mermaid Ave., Phila.

## YARWAY IMPULSE STEAM TRAP

in both directions by shifting brushes.

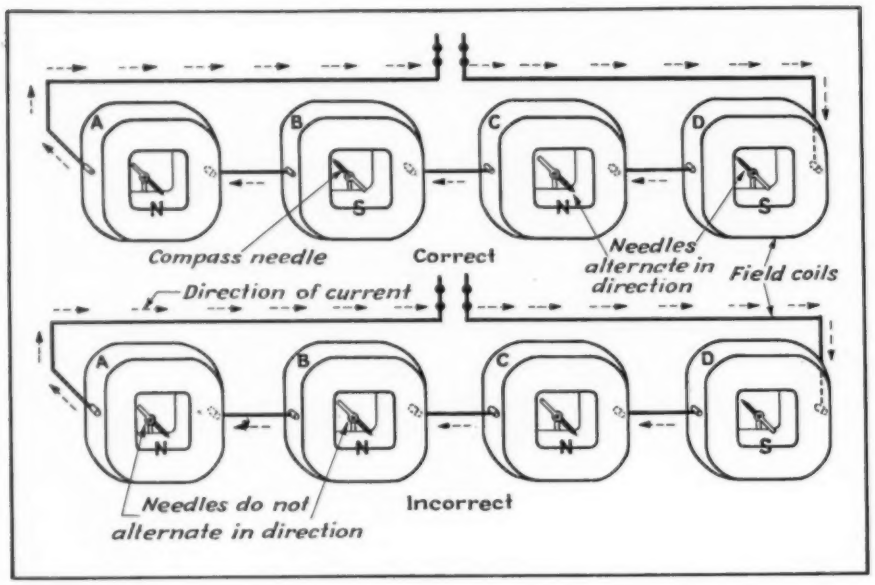
However, because the trouble traces back to the replacement of some of the field coils several years ago, I think the basic trouble lies in an unbalance in the strength of field coils. ENC states that he has checked the coils repeatedly but does not indicate how they were checked. This unbalance may be caused by a different number of ampere-turns or by a slight difference in air gap. Perhaps when reassembling the field poles some shims were inadvertently left out. Commutation on some motors is very sensitive to slight adjustments of this nature.

Differences in the strength of field coils, whether caused by an actual difference in the ampere-turns of the windings or by a variation in the air gap can be detected by measuring the voltage drop across the brush of the machine. Assuming there is a space, say ⅜-in. wide, along the ends of the commutator bars not covered by the brushes, prepare a piece of heavy drawing paper, also ⅜-in. wide. Punch in this drawing paper small holes an equal distance apart. For example, the holes might be ⅛-in. diameter and spaced ⅛-in. apart. This should be done accurately. Secure this paper so that it lies stationary around a segment of the commutator while the commutator rotates. The paper should be possibly five or six inches long, but in no case is it necessary for the paper to extend more than from a point half way between a pair of brushes to the brush and half way beyond.

With a sensitive voltmeter (range about 0-10 volts) measure the voltage between the brush pigtail and the commutator through each of the small holes punched in the paper. Contact with the commutator can best be made by means of an ordinary lead pencil. It will be found that the voltage taken one side of the brush will be positive while the voltage taken the other side of the brush will be negative. It will not be necessary to take voltages beyond the range of a 10-volt meter. These voltages should then be plotted on a piece of graph paper with the voltage scale in one direction and the scale in distance from the brush at right angles to it. The position of the brush should also be indicated on the graph. The voltage curve should pass through zero under the brush, preferably within the center half of the brush.

Follow this same procedure for each one of the six brushes and compare the shapes of the voltage curves. This comparison will give a very clear picture of the distribution of flux under each pole and will indicate where corrective measures should be applied.

*Kalamazoo, Mich.* E E NORMAN




## Three Possibilities

IT IS EVIDENT that ENC must do more thorough testing to find and clear up the trouble.

There are three possibilities to consider and check on. He should find out, if he does not already know, the type of winding on the armature. From the number of burned bars I would say that it is a double-wave winding, (that is, according to the number of bars at each spot).

The first possibility is that of finding two high bars; they will probably be loose, for past commutator dressing would have taken down a tight high bar. A bar may have been pulled loose by prying out coil leads when taking out the old coils.

A second possibility is trouble that will appear or disappear when the motor has warmed up or cooled off. These troubles are hard to locate. There may be a lead that loosens under the heating or cooling conditions, causing a short, or more likely, a high resistance connection. The loose bar may also show this way. When the new coils were put in there may have been a variation in the wire size, or fewer wires in parallel, giving a difference in resistance.

A third possibility involves checking the neutral position of the brushes. The new coils may have changed the armature characteristics, varying the neutral position, and may be giving a neutral position on load conditions that is different from light or no load.

ENC may be checking with a lamp. I would suggest emphatically that he use an ohmmeter, and check the armature coil resistance through the commutator bars, and watch for a point or points, of considerable difference.

*Winslow, Ariz.* J F MAHER

## Needs More Air

### *Answer to Nov Question 2*

### *The Question*

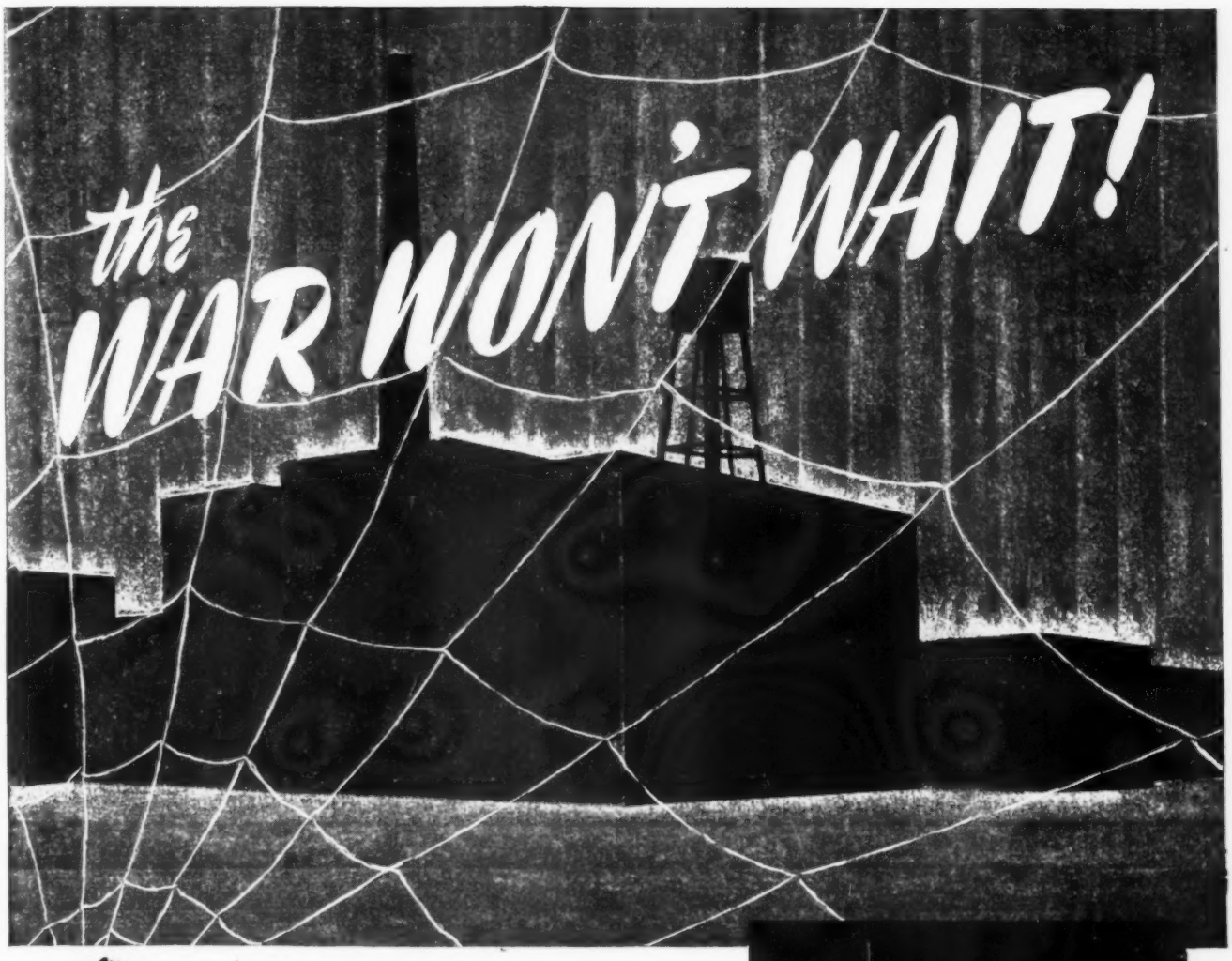
WE HAVE SIX SINGLE-CYLINDER *double-acting single-stage water-cooled 12 x 11-in. 325-cu ft 230-rpm air compressors, each driven by a 60-hp motor. These units are connected to a common header and receivers.*

*Plant changes now being made will require more air than we can now produce. Can the capacity of these units be increased by connecting a centrifugal or displacement blower to act as a booster at the intake? If this method is not practical, what can we do to increase their capacity?*—KN

## Increasing Capacity Overloads Motors

IT APPEARS THAT KN must add more compressors or replace the present ma-

(*Continued on page* 128)



THE War will not wait while you are turbining tubes, won't wait for outages. The power to keep things going is needed twenty-four hours a day, every day. The Nalco System can help you meet this need.

It is a rare occasion when Nalco research and the Nalco System cannot improve plant efficiency. And, that is to be expected. At Nalco the development of better feed-water treatment is a full time job for an outstanding staff of engineers and chemists working in one of the world's finest water treatment laboratories. Ordinary methods cannot hope to approach the results secured by this organization, any more than you can produce an intricate bombsight with a pair of pliers and a hammer.

Now, more than ever before, you need the advantages of the Nalco System.

*Write today for a free survey of your plant.*

*Photograph in Nalco Laboratories, Chicago, Illinois*

•

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THE COMPLETE WATER TREATING SERVICE*

*Plant Survey *plus* Laboratory Research *plus* Controlled Chemicals *plus* Continual Check Reports.

chines with larger-capacity units if he wishes to supply more air to the plant. In air-compressor installations the volume of free air handled by a machine is a function of the piston displacement, the volumetric efficiency and the rpm. The motive power provided is based on the above dimensions and includes little or no spare power in the motor size. Attempting to gain capacity by increasing the speed increases the power needed proportionately, which would result in overloading the motor or driving unit.

No change in piston displacement per stroke or volumetric efficiency is possible, so that only by increasing rpm can more free air capacity be obtained. Increasing the rpm means a greater piston speed, with its lubrication problems and greater stresses imposed on the flywheel, reciprocating parts, and valves. These problems should be fully considered before increasing the speed to get more capacity.

More free air capacity also may be obtained by increasing the intake pressure for a definite piston displacement. However, raising the intake pressure, also increases the power required by the compressor. It is true that the ratio of compression within the cylinder is decreased but the additional weight of air in the cylinder at the end of the intake stroke imposes on the driving motor a larger load than with lower intake pressures. While the lower compression ratio decreases the power demand it does not fully compensate for the additional demand caused by the increased weight of air introduced into the cylinder as a result of higher intake pressures, leaving a net increase in power demand required.

Such a problem as presented by KN demands full study of local conditions before undertaking any change in the installation. If the plant cannot furnish the technical advice needed then a consultant should be called in to help the plant operators plan a prudent course of improvement.

*Baton Rouge, La.* G F MATTHES

## Install Air Reheater

KN CAN OBTAIN MORE AIR from the six compressors in three ways as follows:

(1) Increasing speed by changing pulleys, since units are apparently belt driven. A piston speed of 500 fpm should not be excessive and this would give an increase in output of 18.6% if other factors remain as at present.

(2) Depending on use of air and details of distribution system the volume of air may be increased by installing an air reheater where the air is used. If air can be reheated to 250 F the volume will be increased about 30%.

(3) Increasing air pressure at suction of units with any type of blower or compressor available.

The best method can be determined only by having all data pertaining to air temperatures and pressures as well as use. The compressor manufacturer should be consulted regarding maximum speed and inlet pressure desirable. Both compressors and equipment using air must be maintained in first-class condition to avoid waste. Frequently economies can be made in the use of air by thoroughly checking air tools, distribution system and methods of use.

*St John, N.B.* C G CLARK

## Blower Increases Discharge Pressure

A CENTRIFUGAL BLOWER of ample capacity to boost the intake will help to raise the suction pressure at least a few inches by hydrostatic gage. This will result in an increased discharge pressure assuming the relief-valve settings are raised and the cutouts adjusted to suit this change. Setting up the relief valves and cutouts should not be attempted without the approval of the local inspection bureau and insurance company.

As most industrial equipment of this sort is manufactured by firms of high repute they will gladly give advice and information desired in making changes. It may be possible and permissible to increase the motor speed by raising the voltage, the frequency, or both. This, assuming the plant supplies its own current, should not be a difficult matter.

If these changes are made I suggest that strict attention be paid to the matter of lubrication and cooling water which the increased speed and air temperature will demand. In the present emergency I believe a boost of at least 20% in the air production of these units would be quite within reason.

Incidentally a careful watch should be maintained throughout the plant for any leaks or other forms of compressed air waste. This being one of the most widely used, most convenient, and also one of the most expensive services in our industry, compressed air should not be used in place of a broom or a water hose for floor cleaning.

*Kearny, N. J.* GEORGE MCNALLY

## Purchase New Unit

TO INCREASE THE CAPACITY of KN's compressors the speed of the machines can be raised to step up the air output, providing all other parts of the air-compressor system are correct, that is, intake and discharge piping are proper size, valves in good shape and no leaks present.

KN does not say how much air he needs, whether an increase in speed would take care of his needs, or if a complete change of his air-compressor system is required. An increase in motor speed may be impossible but a change in size of pulley on the driving machine or compressor will do the job. When this is done a close watch must be maintained against overheating both in machines and the motor.

If it is at all possible, purchase a new air compressor that will supply all the manufacturing requirements and still have extra capacity for future use. This unit will soon pay for itself considering the motors now being used on the single units, the upkeep in maintenance for the six machines, the cost of many spare parts that must be carried, and the amount of oil that must be used both in cylinders and crankcases. These items must all be studied when buying new equipment, so as to make the investment profitable.

*Philadelphia, Pa.* T F CUNNINGHAM

✦ ✦ ✦

## Sludge in Transformers

Oil samples removed from a bank of three 833-kva transformers showed considerable sludge. The oil was filtered and thereafter samples were taken at frequent intervals. These samples indicated sludge formation at an alarming rate.

Lifting the cores exposed loose connections between several coil leads and bushing studs which had caused serious arcing and burning of the terminals. Considerable splattering of copper had scattered metallic particles over the coils. Sludge nearly an inch thick covered coils and core, and a heavy coating covered the cooling surfaces and encased the thermometer bulb. Had operation of the transformer been continued under these conditions an accident would have been almost certain to happen. (*The Locomotive*)

NO. 1 OF A SERIES

HOW TUBE-TURN WELDING FITTINGS BENEFIT WAR INDUSTRY

The FIRST WELDING FITTINGS 1ST AND STILL THE BEST

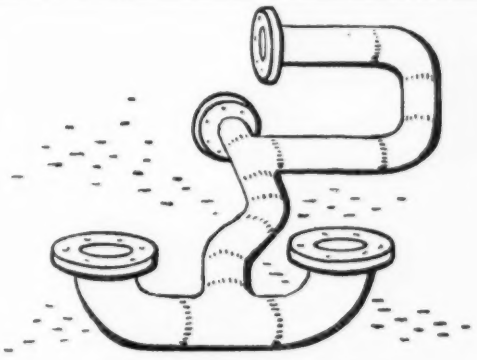
# How Tube-Turn welding fittings speed-up piping installation for war production!

### ASIER, FASTER, SAFER WELDING

be-Turn fittings require only easy circumfer-ial butt welds—which insure faster, better, safer lding by both veteran and novice operators.

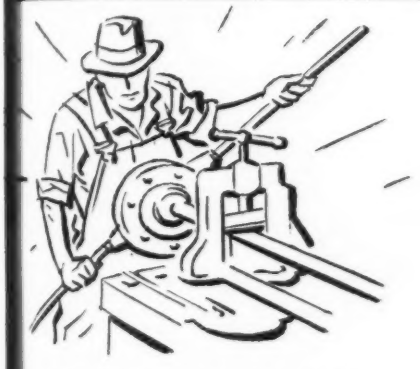
### ALIGNING TIME GREATLY REDUCED

Tube-Turn fittings simplify lining-up operations —because their uniform wall thickness and true circularity permit quick alignment with pipe.



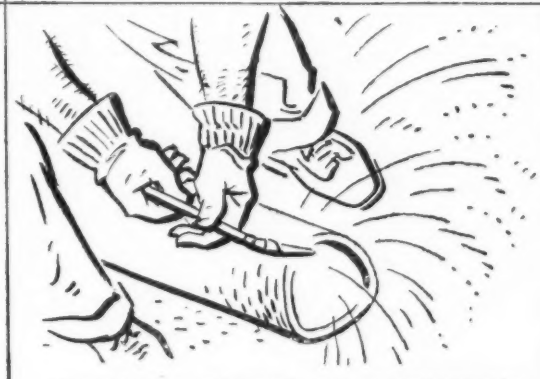
### WHOLE SECTIONS CAN BE PRE-ASSEMBLED

As Tube-Turn fittings and welded joints stand strain and save weight, piping sections can be welded on the ground to save time, then erected.



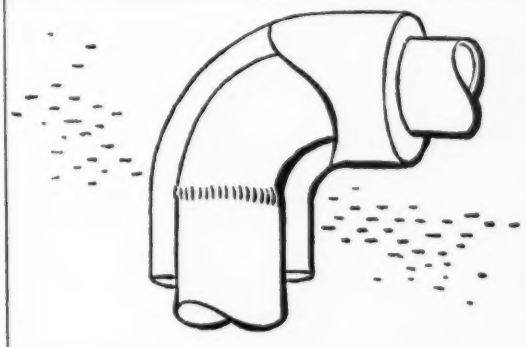
### NO THREADS TO CUT

lding removes the inefficiencies of threaded nts, plus the labor and time applied to thread-. Tube-Turn fittings come ready to install.



### NO TORCH CUTTING OR FABRICATION

Since all Tube-Turn fittings are installed with easy-to-make butt welds, they eliminate time-consuming, complicated cutting and fabricating.



### FASTER AND EASIER TO INSULATE

Tube-Turn fittings are insulated as readily as the pipe, for the welds form one continuous tube. Eliminating many flanged joints shortens covering time.

### EWER FLANGED JOINTS SPEED ERECTION

lding fittings supplant the need for many of e flanged joints necessary in screwed piping, ich materially reduces over-all erection time.

### FEWER HANGERS OR SUPPORTS NEEDED

As welded piping weighs less and stands vibration better than flanged systems, the fewer hangers needed save installation time on these items.

**And you get stronger, leakproof systems that virtually eliminate piping maintenance or failures that can slow down or paralyze vital war industry!**

TUBE TURNS
INCORPORATED

*Branch Offices:* New York, Chicago, Philadelphia, Pittsburgh, Cleveland, Dayton, Washington, D. C., Tulsa, Houston, Los Angeles. *Distributors everywhere.*

TUBE-TURN TRADE MARK *Welding Fittings*

ARMY E NAVY

# About Air Compressors

*Q—What are the characteristics of a good compressor-cylinder oil?*

A—Because of wide variation in factors influencing the selection of lubricating oil it is only possible to establish the approximate minimum or maximum values as shown below.

| | | |
|---|---|---|
| Flash point | 350 F | min |
| Viscosity SSU at 100 F | 245 | min |
| Viscosity SSU at 210 F | 45 | min |
| Pour point | 35 F | max |
| Neutralization No. | 0.10 | max |
| Carbon residue | 2% | max |

*Q—What determines the choice between single- and two-stage compressors?*

A—This choice depends on size of compressor, ratio of compression, discharge temperature limits, cost of power, and permanence of installation. The general dividing line is as follows: for pressures below 60 psi use single stage; above 100 psi two stage; and for the range between 60 and 100 psi use single stage units below 300 cfm.

*Q—What conditions are detrimental to air compressors located in or near a chemical plant?*

A—The intake air may contain acid fumes which will attack iron and steel causing corrosion of valves, piston, and cylinders. Consult the manufacturer for corrective measures when these conditions exist.

*Q—How can moisture be removed from compressed air receivers and lines?*

A—Install automatic moisture traps, water legs, or moisture separators on the compressed air lines. Moisture will not precipitate until the air cools below its saturation point; it is advisable to install an aftercooler between the compressor and receiver.

*Q—What determines the amount of cooling water supplied to an intercooler?*

A—Air leaving the intercooler and entering the h-p cylinder should be as cool as possible if the power input is to be kept at a minimum. Size of intercooler and available quantity of water determine how much heat can be removed from the air. If the discharge-water temperature exceeds 90-100 F, increasing the water supply or cleaning the intercooler may be necessary.

*Q—Will extremely cold cooling water cause condensation within the compressor cylinder?*

A—Condensation takes place if the cooling water flows when the compressor is shut down, and may also occur in the cylinder during operation if cold water is fed directly to the cylinder jacket. Cooling water should be passed through the intercooler before it enters the h-p jackets. Another method is to regulate the cylinder-jacket water flow to maintain a discharge water temperature of 100-115 F.

*Q—What is the correct rate of oil feed for compressor cylinders?*

A—The amount of oil required varies with the kind of machine and local operating conditions. The minimum rate of feed should not be less than that given in the accompanying table.

| CYLINDER DIAMETER in. | PISTON DISPLACEMENT per cyl, cfm | SWEPT SURFACE PER CYLINDER sq ft per min | OIL, drops per min |
|---|---|---|---|
| Up to 6 | Up to 65 | Up to 500 | 2d in 3m. |
| 6 — 8 | 65 — 125 | 500 — 750 | 1 |
| 8 — 10 | 125 — 225 | 750 — 1100 | 4d in 3m. |
| 10 — 12 | 225 — 350 | 1100 — 1500 | 1 — 2 |
| 12 — 15 | 350 — 600 | 1500 — 2000 | 2 — 3 |
| 15 — 18 | 600 — 1000 | 2000 — 2600 | 3 — 4 |
| 18 — 24 | 1000 — 1800 | 2600 — 3600 | 4 — 5 |
| 24 — 30 | 1800 — 3000 | 3600 — 4800 | 5 — 6 |
| 30 — 36 | 3000 — 4500 | 4800 — 6000 | 6 — 8 |
| 36 — 42 | 4500 — 6500 | 6000 — 7500 | 8 — 10 |
| 42 — 48 | 6500 — 9000 | 7500 — 9000 | 10 — 12 |

*Courtesy of Compressed Air Institute*

*Q—What is the effect of altitude on the operation of a compressor?*

A—Air drawn into a compressor operating at a high altitude is compressed to a smaller volume than if the intake were at sea level where air density is greater. Allowance must be made for air density when calculating the output of a compressor for installation at high altitudes.

*Q—Why should a safety-relief valve be installed on an air compressor?*

A—Whenever it is possible to close the discharge line from a compressor, a safety valve, with a capacity great enough to exhaust the full compressor output, must be installed at the compressor outlet. Starting a compressor with closed discharge may build up sufficient pressure to burst the cylinder.

*Q—What precautions should be taken when using a closed cooling water system on a compressor?*

A—Sight-flow indicators should be installed on all discharge lines to check the water flow. Open funnel bypasses permit making periodic tests for water jacket air leaks and measuring discharge water temperature.

*Q—What is meant by the viscosity of an oil? How is it determined?*

A—Viscosity of an oil is a measurement of its resistance to flow or its internal fluid friction. It is determined by the length of time required for a measured quantity of oil to flow through a given orifice. Internal friction of an oil varies with its temperature so that the temperature must be given when the viscosity is stated. As each of the several standard viscosimeters use different size orifices, the name of the viscosimeter must also be given.

*Q—What is the difference between adiabatic and isothermal compression?*

A—Air is compressed adiabatically when no heat is transferred, either to or from the air, from any surrounding bodies such as piston and cylinders. Therefore the air temperature increases. When air is compressed isothermally heat is removed at such a rate that the air temperature remains constant. Neither condition prevails in compressors.

# NO MORE UNSCHEDULED *Black-Outs* HERE!

# SOLNUS OILS

## End Carbon Trouble . . . Stop Ring Sticking

Black-outs weren't always scheduled by the Army interceptor command in a certain Eastern town before they switched to Solnus Oils.

What did a change in lubricants have to do with black-outs? Just this! All of the town's power and light were supplied by two large Fairbanks-Morse diesel driven generators . . . and a breakdown of the diesels could mean lights out for everyone. And breakdowns did occur! But they were due entirely to faulty lubrication. Carbon built up . . . rings stuck . . . and operating temperatures soared. The engines became noisy . . . cylinder walls scored.

The advice of a Sun Lubrication Engineer soon put a stop to any breakdowns. This Doctor of Industry simply recommended a change from competitive oils to Solnus Heavy Oil. Since then these engines have been running quieter and cooler. Shutdowns have been reduced 66% . . . trouble with carbon and ring sticking stopped . . . and there hasn't been a sign of additional cylinder scoring.

This is another example, taken from the many in Sun Oil records, of how Sun's Doctors of Industry have proved themselves trouble-shooters for industry's lubrication problems. Whatever your problem, involving any petroleum product, call in a Sun Oil Engineer. His services are yours to use to help speed victory with more production. Write . . .

**SUN OIL COMPANY • *Philadelphia***

*Sun Oil Company, Ltd., Canada*

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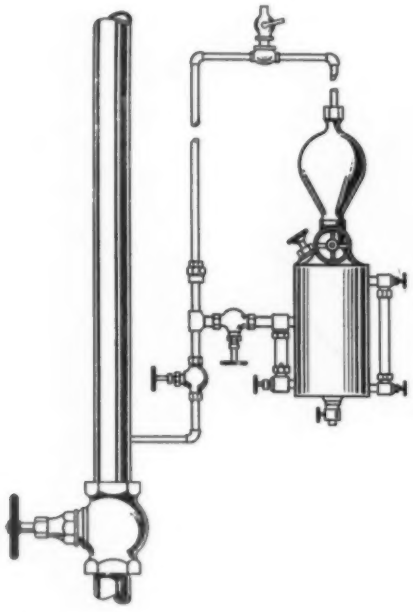
**SUN PETROLEUM PRODUCTS** ***HELPING INDUSTRY HELP AMERICA***

# ARGUMENT CORNER



## Air Vent Cures Lubricator Trouble

WHEN I BEGAN work in my present position I found the same hookup on a lubricator as shown by Alex Gray in Fig. 1, page 115, October, 1942 POWER. I made the same change in the lubricator piping as Mr Gray did but left the lubricator connected into the steam line on the live side of the throttle valve, as in the figure. After I made the change air trapped in the top of the loop reduced the hydrostatic head on the lubricator.

To get rid of the air I opened the bottom drain cock with steam on the lubricator and blew the water out of the condenser chamber. Then there was a long wait for the chamber to cool enough to provide again sufficient condensate in the loop to move oil through the sight feed. To eliminate this trouble I installed a petcock in the top of the loop, as in the figure, to blow out the air without blowing the water from the hydrostat leg. This cured the trouble and left the lubricator ready for immediate use.

*Vancouver, B. C.* R MANLEY ORR

## Upside-Down Boiler

I READ THE STORY of the "Upside-down Boiler" in the November issue of POWER with much interest and amusement.

I wonder if the readers of POWER are aware that there was in 1876, a rotary boiler mounted on trunnions, the drum of which was revolved over the fire, so that "it would secure equal heating throughout, and consequently equal heating and expansion with absolute safety from bursting"?

This boiler was described in detail in an article appearing in the July issue (1876) of the *Manufacturer and Builder*. The article has several cuts describing the construction and mentions a test made by the noted Prof R H Thurston. It was made, evidently, by the Price Rotary Tubular Boiler Co, 95-97 Liberty St, New York, and was exhibited at the Centennial Exhibition at Philadelphia, Pa., that year.

Fortunately, I have in my possession the bound volume of the 1876 *Manufacturer and Builder*, and get much amusement in seeing how power plant engineering was conducted over half a century ago.

*Lowell, Mass.* CARL F PALMER

## Here's An Argument

A RECENT EDITORIAL NOTE invited readers to start arguments on pet subjects. I want to argue that there is no justification for 440 volts.

The original purpose of 440 volts was to reduce wiring costs through the reduction of current and higher permissible voltage losses. Development of the 3-phase 4-wire network systems and primary distribution, with transformers at load centers, gives us a choice of plants in which the same equipment is adaptable for single or composite plans.

Using 440 volts is as senseless as the old experiment of using three 110-120-volt single-phase systems for lighting and a separate 3-phase 220-volt system for motors in the same project, when a 3-phase 4-wire 120-208-volt system would serve both purposes. To save space I shall assume that the "arguers" understand all features of these systems.

For a small plant, 3-phase 4-wire 120-208 volts serve both light and power. For a moderate plant this may be a secondary network supported by transformers at required points. For extensive plants this may be a primary feed system with groups of secondary (either radial or network). In all of the

(*Continued on page* 148)

"This is Mr. Bonepart, in charge of our skeleton force on Sundays and holidays"

# All-out industrial production proves practical values of Copper Tubes . . .

With so much attention being paid, and imperatively so, to the preservation of existing equipment, the value of copper piping becomes doubly apparent. Who can calculate . . . in terms of replacement metal saved, in terms of production gained . . . the worth today of copper tube installations made before the war by so many far-sighted industrial plants?

Anaconda Copper Tubes, with solder-type fittings, are economical, rustproof, dependable. They stubbornly resist corrosion . . . offer least resistance to flow because of smooth interiors, thus reducing pumping costs. They save space . . . they're easy to bend . . . easy to adapt to changed plant layouts.

Bearing in mind that at present the non-essential use of copper is rigidly restricted, we nevertheless recommend that you obtain for present and future reference a copy of our Publication C-24, "*Anaconda Copper Tubes for Industrial Applications*".

ANACONDA

4249

## *Anaconda Copper Tubes*

THE AMERICAN BRASS CO. • General Offices: Waterbury, Conn.

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# POWER LINES

## Ripley Tells New York Power Engineers About Power for War

The story of how electricity helps "keep 'em flying, keep 'em rolling and keep 'em sailing" was told before Greater New York Association, National Association of Power Engineers, Friday evening Nov 13, by Charles M Ripley of the General Electric Co. Thanks to Thomas Edison, he said, the electrical industry was created in the USA and it has spread across the world —all in one lifetime. So it is only natural that we should and do now use one third of all the world's electricity. Last year we used ten times as much as in 1916 during World War 1. The increased use in 1941 over 1940, is almost equal to the total used for all purposes in 1917.

A kilowatt-hour, (one unit of electricity), he said, is a unit of work equal to that necessary for a man to climb to the top of the Washington Monument 35 times; and it sells for 5¢. No man can produce a kilowatt-hour in a day. Two men pedalling at top speed for the six days and six nights of a bicycle race, could not do an amount of work which could be bought in electrical form for 78¢. A strong man can put forth only an average of 35 watts of muscle power, during 8-hr work, at the average task.

He demonstrated an electrically heated flying suit, together with gloves and shoes, which keep our army pilots fit and comfortable and nimble-fingered, at 60 F below zero—six miles up. Also, it gives far more freedom of action and comfort than the old bulky sheepskins. And the electric outfit weighs less, and costs about half as much. Mr Ripley said the army's first order for this suit was for 12,000—said to be one of, if not the largest order ever placed for an electrical appliance.

As he continued, he described the superchargers which permit planes to climb to a height of six miles, by compressing the rarified air to sea-level richness. This sea-level air is piped to the carburetor in such quantities as to keep power production at sea-level capacity, even in the rarified atmosphere. The superchargers are run by the exhaust gases from the airplane engines. These gases strike the drive-wheel at a speed of 1200 miles an hour, 20 times that of a hurricane. This wheel turns at a speed of 24,000 rpm, or 100 times around while you wink once. The heat of the exhaust gases is hot enough to melt lead, tin, zinc, aluminum and magnesium; and almost enough to melt brass.

So the wheels run red hot, and the pipes that convey the exhaust gases have been photographed in the dark because they are red hot. An additional problem of engineering design, is that the metal in the wheels must be able to withstand the chemical action of the combustion products in the gases. The little wheel, a foot in diameter and a half-inch thick, must not bend or erode from the blast, it must not corrode from the chemicals, and it must not explode from the high speed, although running red hot.

Uncle Sam is building four-engine bombers with 8000 hp each, that is, with more power than any single railroad locomotive in the world, and electricity makes it possible, he declared. All army bombers have engine-driven generators which make electricity for charging the plane's battery and running the radio, motors and lights. Most magnetos, and now some generators use Alnico permanent magnets. He explained that these new alloy-magnets are 30 times as powerful as the best in World War 1; and they save weight and gasoline wherever they supersede the older electromagnets with their heavy coils of wire.

He exhibited an incendiary bomb that was dropped on Liverpool, but failed to go off or burn. He also showed several buckets of turbines used for propelling cruisers and destroyers. These buckets are now in mass production for the first

(*Continued on page* 176)

### POWER's History

POWER was founded in 1884 by E P Harris and H M Swetland. With it was incorporated *Steam*, which had been started by N Hawkins in Chicago two years earlier.

In 1903 POWER purchased and absorbed *Science and Industry*, which was a consolidation of a number of periodicals, namely, *Home Study Magazine, Home Study for Machinists, Mechanic's Magazine, Home Study for Building Trades, Building Trade's Magazine, Home Study for Electrical Workers* and *Steam Electric Magazine.*

In 1908 POWER absorbed *The Engineer's Review*, of Cleveland, and *The Engineer*, of Chicago, the latter being a consolidation of *The Safety Valve, Lord's Power and Machinery Magazine, The Stationary Engineer, Steam Engineering* and *The Mechanical Engineer.* When *The Engineer* was purchased, the name of the combined magazine was *Power and the Engineer.* The title was condensed to POWER in 1911. All rights to the preceding titles reserved.


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**(Send to Circ Dept, POWER, 330 W 42nd St, New York, N. Y.)**

# THE SCIENTIFIC APPROACH TO YOUR PIPING PROBLEMS

***Some of the many operations taking place under rigid engineering control which are standard practice in Power Piping Division. These practices provide better piping to meet the wartime need for speed, quality and economy.***

1—Strict furnace control with optical pyrometer during heating preceding bending operations.

2—Annealing to improve grain structure.

3—End preparation for welding.

4—Preheating and maintenance of heat during welding.

5—Welding . . . cleaning . . . chipping.

6—Stress relieving welded joints to restore grain structure.

7—Sub-assemblies aligned and finished to specification.

8—Hydrostatic testing and inspection.

**Highly developed procedures provide economical erection. Power Piping Functional Hangers and Vibration Eliminators adequately control the behavior of your piping system.**

Machining being completed on sub-assembly which permits erection to be made with machining tolerance.

**The correlated use of FLEX-ANAL CHARTS and HANGER BULLETIN 1863 saves time in engineering man power which can be devoted to other useful purposes. Copies of these books can be obtained through a**

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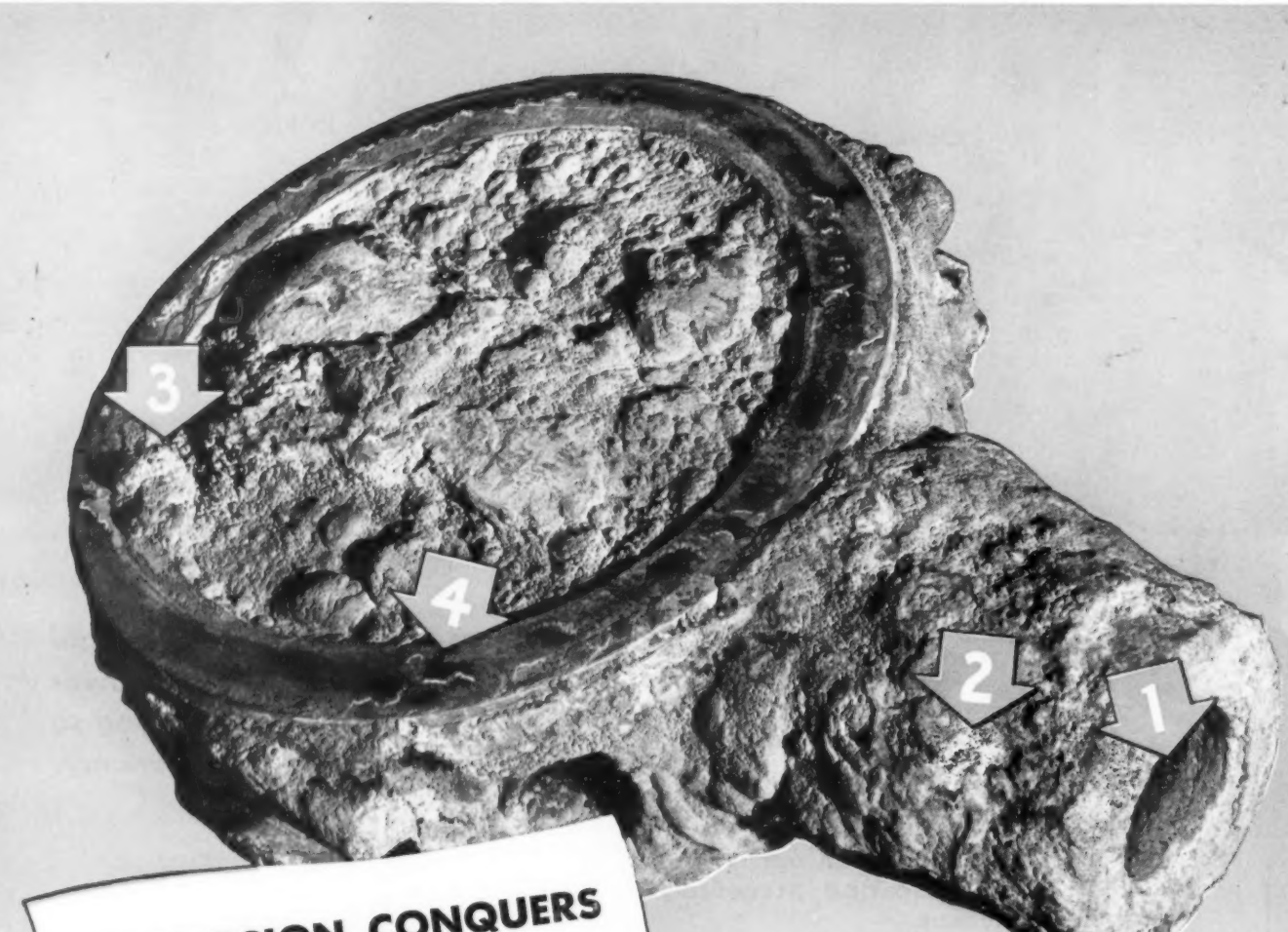
1626 PENNSYLVANIA AVE. PITTSBURGH, PA.

# *Prevent* Valve Failur




**CORROSION CONQUERS ANOTHER VALVE when proper maintenance is neglected . . . . . .**

This wedge of an Iron Body O. S. and Y. Gate Valve *should* be still in use, good for many more years of service. Instead, it is worthless, discarded. Unchecked corrosion completely destroyed the threads (1) and the wedge pin (2), allowing the wedge to drop off the spindle and shut off the water supply. Production was stalled several hours, until the trouble could be located and corrected.

Analysis of the water conditions when the valve was installed would have indicated the need for a valve made of a metal more resistant to corrosion. But, even with *this* wedge, proper maintenance would have checked the destruction, and prevented the serious interruption in plant operation.

# JENKINS VALVES

# before it starts!

Inspection at frequent intervals would have revealed the excessive corrosion, and measures could have been taken to minimize the ruinous effects, such as water treatment and periodic cleaning. The accumulation of deposit (3) which threatens the eventual destruction of the seat ring (4) would then have been prevented.

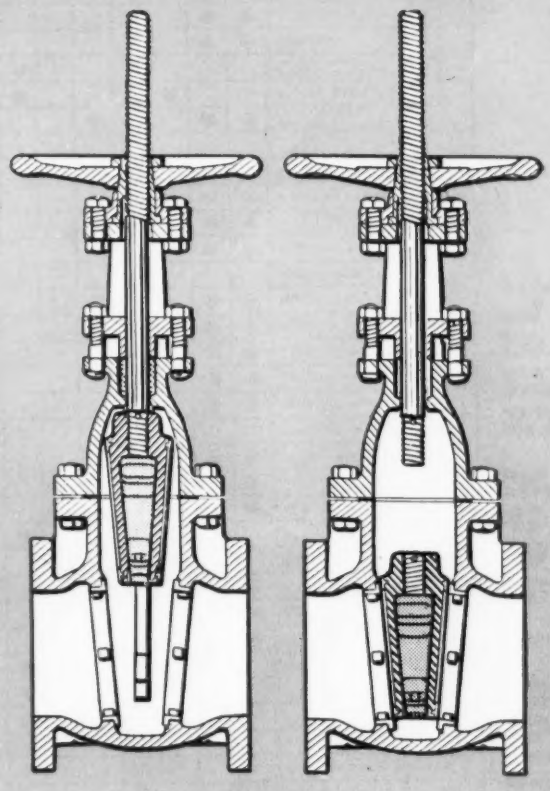
This valve failure clearly demonstrates the importance of frequent, systematic inspection, and the repair or replacement of worn parts before a valve destroys itself. It also shows the need for careful selection and proper installation of valves suited to the particular service conditions. If these simple precautions are followed, and maintenance workers are thoroughly instructed, most valve troubles can be prevented before they start.

Interruption in production may have far-reaching effects in the present emergency. It can seriously retard the delivery of materiel needed by our armed forces. Preventable valve failure is also an inexcusable waste of critical metals. Every management should take all steps necessary to keep valves operating at top efficiency.

Consult Jenkins engineers for any advice you need in improving your system of valve conservation.

Army-Navy "E" Pennant awarded to Jenkins Bros. for high achievement in the production of war equipment.

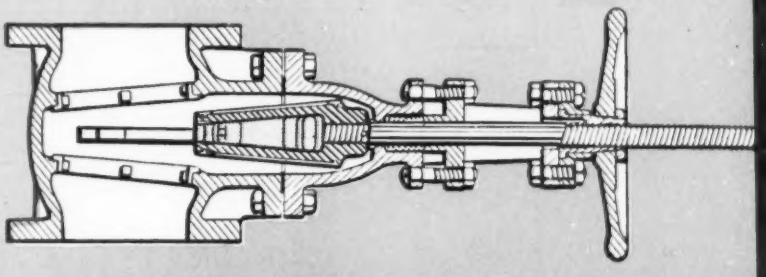
Jenkins Bros., 80 White Street, New York, N. Y.; Bridgeport, Conn.; Atlanta, Ga.; Boston, Mass.; Philadelphia, Pa.; Chicago, Ill. Jenkins Bros., Limited, Montreal; London, England.



## PROPER INSTALLATION WOULD HAVE MINIMIZED TROUBLE

The valve was installed in the main supply line, in the usual horizontal position, with spindle vertical, and was left open most of the time. As shown in above sketches, the raised spindle indicated that the valve was "open" after the wedge had dropped, and locating the cause of the stoppage was made extremely difficult.

In certain services, where a valve is infrequently operated, it is often desirable to install it with the spindle horizontal. Then, if the wedge should become detached from the spindle, it cannot fall into the closed position.



For every industrial, engineering, marine and power plant service

★ BRONZE ★ IRON ★ STEEL ★

# Motor Application Check Chart

| SPEED CLASSIFICATION | POWER SUPPLY | TYPE OF MOTOR | ** RANGE OF HORSEPOWER RATINGS | STARTING TORQUE PER CENT OF FULL LOAD | MAXIMUM TORQUE PER CENT OF FULL LOAD | SPEED REGULATION PER CENT SLIP | GENERAL REMARKS | TYPICAL APPLICATION: AGITATORS - MIXERS | BALL - ROD - PUG MILLS | BALING PRESSES | BENDING ROLLS | BLOWERS - POSITIVE PR | BORING MILLS | BUCKET ELEVATORS | BULLDOZERS | CAPSTANS - CAP PULLERS | COMPRESSORS | CONVEYORS - LOADED START | CRANES - HOISTS - ELEVATORS | CRUSHERS - GRINDERS - WITH FLY-WHEEL | CRUSHERS - GRINDERS - NO FLY-WHEEL | DOUGH MIXERS | DRILLING MACHINES | DRYING TUMBLERS - CYL | EXTRACTORS - LORY & CHEM | FANS - CENTRIFUGAL | FANS - PROPELLER | GRINDERS - BUFFERS | HAMMER MILLS | IRONERS - FLATWORK | LATHES | LINE SHAFTS | MILLING MACHINES | MOTOR-GEN. AC - DC | MOTOR-GEN. DC - AC | MOULDERS - TENONERS | PLANERS - JOINTERS - SURFACERS | PRINTING PRESS - JOB | PRINTING PRESS - FLAT BED | PRINTING PRESS - ROTARY & OFFSET | PUMPS - CENTRIFUGAL - TURBINE | PUMPS - DISPLACEMENT | PUNCHES - SHEARS - HAMMERS | SANDERS | SAWS - CIRCULAR | SAWS - BAND | SHAPERS | STOKERS | VALVES | WASHERS - REV MOTOR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CONSTANT SPEED | ALTERNATING CURRENT 3 & 2 PHASE | STANDARD SQUIRREL CAGE NORMAL TORQUE - NORMAL STARTING CURRENT | ½ TO 300 HP | 150 | 200 TO 250 | 2 TO 5 | GENERAL PURPOSE WIDE APPLICATION | ● | | | | ● | ● | | | | | | | | ● | | | | | ● | ● | ● | | ● | ● | ● | ● | ● | ● | ● | | | | ● | | | | | | | |
| | | SQUIRREL CAGE NORMAL TORQUE - LOW STARTING CURRENT | 7½ TO 200 HP | 125 TO 150 | 200 TO 225 | 2 TO 5 | SIMPLE CONTROL | ● | | | | ● | ● | | | | | | | | ● | | | | | ● | ● | ● | | ● | ● | ● | ● | ● | ● | ● | | | | ● | | | | | | | |
| | | SQUIRREL CAGE HIGH TORQUE - LOW STARTING CURRENT | 3 TO 100 HP | 200 TO 250 | 175 TO 225 | 4 TO 5 | HEAVY STARTING SIMPLE CONTROL | | ● | | | | ● | | | | ● | ● | | ● | | | | | | | | | ● | | | | | | | | | | ● | | | | | | | | |
| | | SQUIRREL CAGE HIGH TORQUE - HIGH SLIP | ½ TO 100 HP | 200 TO 300 | 200 TO 300 | 8 TO 15 | HEAVY STARTING - INTERMITTENT AND FLUCTUATING LOAD | | ● | ● | ● | | ● | ● | ● | ● | | ● | ● | ● | | | | | | ● | | | | ● | | | | | | | | | | ● | | | | | | | | |
| | | SQUIRREL CAGE LOW TORQUE - LOW STARTING CURRENT | 40 TO 100 HP | 50 TO 80 | 125 TO 150 | 4 TO 5 | SPECIAL PURPOSE CONSTANT LOAD LIGHT STARTING | | | | | ● | | | | | | | | | | | | | | | ● | ● | | | | | | | | | | | ● | | | | | | | | |
| | | SQUIRREL CAGE LOW TORQUE | ½ TO 10 HP | 100 TO 125 | 175 TO 200 | 4 TO 5 | SPECIAL SERVICE SMOOTH REVERSAL | | | | | | | | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | | | | ● |
| | | WOUND ROTOR | ½ TO 300 HP | 200 TO 250 | 200 TO 250 | * | FREQUENT & HEAVY STARTING | | ● | | ● | | | ● | ● | ● | ● | ● | ● | ● | ● | | | | | | ● | | | | | | | | | | | | | | | | | | | | |
| | SING PHASE | CAPACITOR - INDUCTION LOW TORQUE | ½ TO 10 HP | 50 TO 75 | 175 TO 200 | 4 TO 6 | LIGHT STARTING DIRECT CONN. LOAD | | | | | | | | | | | | | | | | | | | | ● | ● | | | | | | | | | | | | | | | | | | | |
| | | CAPACITOR - INDUCTION NORMAL TORQUE | ½ TO 10 HP | 150 TO 200 | 175 TO 200 | 4 TO 6 | GENERAL PURPOSE INFREQUENT STARTING | ● | | | | ● | | | | | ● | | | | ● | | | ● | | | | | ● | | | ● | ● | | | | | ● | ● | | | | | ● | | | |
| | DIRECT CURRENT | SHUNT WOUND | ½ TO 75 HP | 150 | ƒ | 5 TO 10 | GENERAL PURPOSE STEADY LOADS | ● | | | | ● | ● | | | | ● | | | | ● | ● | ● | | | | ● | ● | ● | | | ● | ● | | ● | ● | | | | | ● | | | | | | |
| | | COMPOUND WOUND | ½ TO 75 HP | 175 TO 200 | ƒ | 10 TO 25 | HEAVY STARTING FLUCTUATING LOAD | | ● | ● | | | ● | ● | | | ● | ● | ● | ● | | | | | ● | ● | | | | | | | | | | | ● | ● | ● | | | ● | ● | | | | ● |
| | | SERIES WOUND | ½ TO 75 HP | 300 TO 400 | ƒ | * | HEAVY AND FREQUENT STARTING | | | | ● | | | | | ● | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| AJUSTABLE SPEED | AC 3 & 2 PHASE | CONSTANT HORSEPOWER 2 - 3 - 4 SPEEDS | ¼ TO 150 HP | 125 TO 150 | 175 TO 200 | 4 TO 6 | SPEED INDEPENDENT OF LOAD | | | | | ● | ● | | | | | | | ● | | | ● | | | | ● | | | ● | | ● | | | | | | | | | | | | | |
| | | CONSTANT TORQUE 2 - 3 - 4 SPEEDS | ¼ TO 200 HP | 125 TO 150 | 175 TO 200 | 4 TO 6 | SPEED INDEPENDENT OF LOAD | ● | ● | | | ● | | ● | | | | ● | ● | | | ● | | | | ● | | | | ● | | | | | | ● | ● | ● | ● | ● | | ● | | | | |
| | | VARIABLE TORQUE 2 - 3 - 4 SPEEDS | ¼ TO 200 HP | 125 TO 150 | 175 TO 200 | 4 TO 6 | SPEED INDEPENDENT OF LOAD | | | | | | | | | | | | | | | | | | | ● | ● | | | | | | | | | | | | | | | | | | | |
| | DIRECT CURRENT | FIELD CONTROL | ¼ TO 50 HP | 150 | ƒ | 5 TO 10 | WIDE RANGE FLEXIBLE CONTROL | | | | | | ● | | | | | | | | | ● | ● | | | | | ● | | ● | ● | | | | | | | | | | | | ● | ● | | |
| | | VARIABLE VOLTAGE CONTROL | ¼ TO 30 HP | 150 | ƒ | * | EXTREME WIDE RANGE FLEXIBLE CONTROL | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| VARIABLE SPEED | AC | WOUND ROTOR | ½ TO 300 HP | 200 TO 250 | 200 TO 250 | * | LIMITED RANGE HEAVY STARTING | ● | ● | | ● | ● | | ● | ● | | | ● | ● | | | | | ● | ● | | | ● | | | | | | | | | ● | ● | ● | ● | | | | | | |
| | DIRECT CURRENT SHUNT | ARMATURE CONTROL | ½ TO 75 HP | 150 | ƒ | * | LIMITED RANGE DEPENDENT ON LOAD | ● | | | | ● | | | | | | | | | | | | | | | ● | ● | | | | | | | | | | | | ● | | | | | | | |
| | | FIELD AND ARMATURE CONTROL | ½ TO 50 HP | 150 | ƒ | * | WIDE RANGE LIMITED APPLICATION | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | ● | | | | | | | |
| | | VARIABLE VOLTAGE CONTROL | ¼ TO 30 HP | 150 | ƒ | * | WIDE RANGE LOW EFFICIENCY | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | ● | | | | | | | |
| | DIRECT CURRENT COMPOUND | ARMATURE CONTROL | ½ TO 75 HP | 175 TO 200 | ƒ | * | LIMITED RANGE DEPENDENT ON LOAD | | ● | | | | ● | ● | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | ● | | | | | | |
| | | FIELD AND ARMATURE CONTROL | ½ TO 50 HP | 175 TO 200 | ƒ | * | WIDE RANGE LIMITED APPLICATION | | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | VARIABLE VOLTAGE CONTROL | ¼ TO 30 HP | 175 TO 200 | ƒ | * | WIDE RANGE LOW EFFICIENCY | | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SER | ARMATURE CONTROL | ½ TO 75 HP | 300 TO 400 | ƒ | * | LIMITED RANGE HEAVY STARTING | | | | ● | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

* DEPENDENT UPON LOAD AT NORMAL SPEED

** HORSEPOWER RATINGS, TORQUE AND REGULATION DATA IS FOR 4 POLE (1800 RPM) 60 CYCLE AC MOTORS AND 1750 RPM DC MOTORS

ƒ MAXIMUM TORQUE IS LIMITED BY COMMUTATION. UNDER NORMAL CONDITIONS DC MOTOR DEVELOPS 200 TO 400% MAXIMUM TORQUE MOMENTARILY

*Courtesy The Louis Allis Co, Milwaukee, Wis.*

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POWER'S DATA SHEETS
Number 125

# How to Make an Old COPES Valve Like New in Sixty Minutes

UNCLE SAM wants to keep COPES equipment in active service as long as possible and so do we. With more than 60,000 of these COPES Valves in service, you can make a real contribution to the war effort by "keeping them regulating at top efficiency." Lucky for you and for us it is a simple routine job. The only moving part in the valve, lifts out with the removal of four studs. The two seats come out with a simple tool. By replacing as a matched set the plunger cylinder and the new seats, the valve is like new again.

## ATTENTION 60,000 COPES USERS!

▶ COPES' Users, let's get together to keep these 60,000 boiler water level guardians in fighting trim. Their simple, sturdy design makes it easy and economical. Write for recommendations modernizing your COPES Feed Water System.

**NORTHERN EQUIPMENT COMPANY • 131 GROVE DRIVE, ERIE, PA.**

*Feed Water Regulators • Pump Governors • Differential Valves • Liquid Level Controls • Reducing Valves and Desuperheaters*

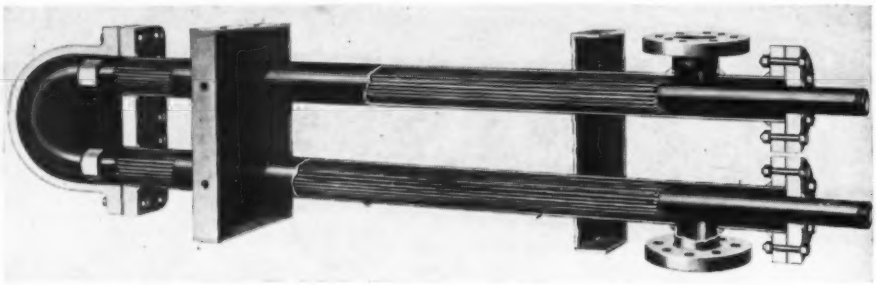
BRANCH PLANTS IN CANADA, ENGLAND — REPRESENTATIVES EVERYWHERE

OVER 60,000 COPES FEED WATER REGULATORS IN SERVICE

★ GET CLOSER LEVEL CONTROL WITH THE COPES FLOWMATIC ★ REGULATOR

FEEDS BOILER ACCORDING TO STEAM FLOW-AUTOMATICALLY

# WHAT'S NEW IN PLANT EQUIPMENT



## Heat Exchangers *(above)*

COMPANY ANNOUNCES that it will build and sell complete ready-to-use heat exchangers for the duration of the war, as a service to buyers who are unable to get needed equipment from their usual sources of supply. Heat exchangers will be built in all standard types—including the twin-section unit shown in photograph—and in any capacity desired to meet practically any heating and cooling requirements. Brown Fintubes will be employed as the heat transfer tube in all cases. *The Brown Fintube Co, Heat Exchanger Division, Elyria, Ohio.*

## Wrenches

TORQUE-MEASURING WRENCHES range in capacity from small instrument building wrenches of a few inch-pound capacity to 2-handled torque wrenches of 722-inch pound capacity. Wrenches used in leading diesel engine plants, according to the maker, especially for assembly and inspection, to gage or measure the torque applied, and tightening critical screws and bolts, and to equalize control or bring the screws to a predetermined torque. *P A Sturtevant Co, Addison, Ill.*

## Tilt Trap

THREE-VALVE TILT TRAP designed for variable pressures on lifting service announced as addition to line of deaerating system for steam drainage and boiler feeding. Sturdy construction of female trunnion supported on center bearings, and male steam at water ends which are relieved of any weight carried on the packing, is the same as that used on the basic Acker return and non-return tilt traps. *W M Acker Organization, Cleveland, Ohio.*

## Laminated Solenoids

DAVIS LAMINATED solenoids designed for specification by the engineer-designer to supply a straight-line thrust, by magnetic action, for the operation of hydraulic valves and for general industrial uses. Maximum magnetic force for a given electrical input effected by the design, the laminated frame and plunger, and other points of construction. Coils may be paper-section wound, cloth-taped, and treated with special synthetic resins to make them impervious to cutting oils or coolant. These heavily treated coils provide utmost protection against short circuits. Installation is easy for either direct or remote control, and quick, short thrusts. *Dean W Davis Co, Inc, 549 W Fulton St, Chicago, Ill.*

## Soldering Iron

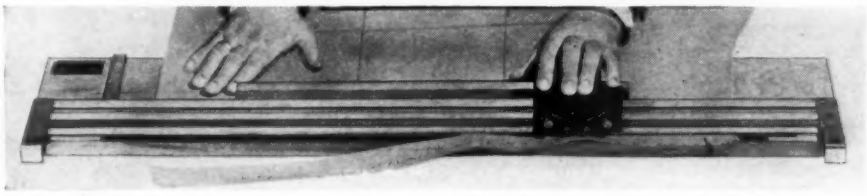
HEXACON HATCHET soldering iron has its principal advantage in that it gives better balance on certain soldering operations and decreases operator fatigue. By doing so, manufacturer states, production is increased and quality of soldered joint improved. Has all the features of the regular Hexacon industrial soldering irons. *Hexacon Electric Co, 161 W Clay Ave, Roselle Park, N. J.*

## Resurfacer

INSTANT-USE is ready-mixed floor patch that enables repairs to be quickly made to ruts and holes. Floor can be used immediately without any time being required for setting or hardening after the repair has been made. Because Instant-use patches have been developed for use in heavy industries, big loads will improve rather than destroy the new tough patches, maker says. As Instant-use compacts under constant traffic, it becomes a part of the floor itself. *Flexrock Co, 23rd & Manning Sts, Philadelphia, Pa.*

## Trimming Machine *(below)*

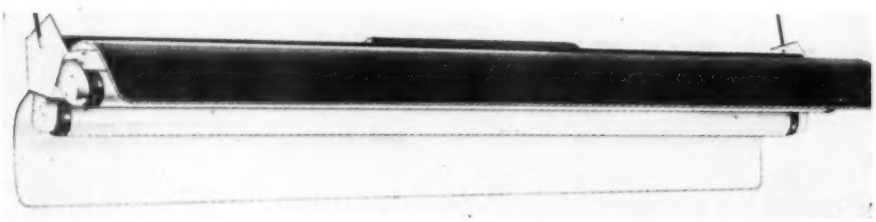
IDEAL-CUT TRIMMING MACHINE replaces scissors, rules, knives, etc., and is used for trimming or cutting to size blueprints, drawings, papers, tracing cloth, cardboard skins, leather, cloth, etc. Trimmer utilizes old razor blades, and maintenance cost is kept to practically nothing. Unit cuts plans of all sizes and many thicknesses, square, oblong or triangle. Margins can be obtained around frame automatically, from $\frac{3}{8}$ to 2 in. Material to be cut is automatically held in place by spring hinges placed on rail guide. Cutting is performed back and forth by two razor blades on a sliding block and secured in place by nuts in a protected arrangement. *Edi Trimming Machines, 609 West 115 St, New York, N. Y.*



## Non-Metal Reflectors *(left)*

COMPANY IS PRODUCING two new types of fluorescent units featuring a non-metal reflector known as Lumenite. Lumenite, a composition material, is tough and strong, moisture and heat-resistant, non-corrosive, non-scaling, with a dur-

(*Continued on page* 162)



# LET'S GET IN THE SCRAP
# —but not make it!

IT'S OUR DUTY TO GET BETTER AND LONGER SERVICE FROM VALVES!
GATE VALVES
WHAT TO DO IN REPAIRING LEAKY GATE VALVES
GLOBE VALVES
HOW TO RE-GRIND OR RENEW DISC AND SEAT
FOR VICTORY'S SAKE —KEEP VALVES IN GOOD REPAIR!
HOW TO KEEP YOUR PLANT GOING WITHOUT
How to Repair Valves
TO GET RENEWED LIFE FROM GATE AND GLOBE VALVES
TO CONSERVE CRITICAL METALS

## *"Piping Pointers" Show You How To Reclaim Valves*

THE steel mills need all the scrap they can get. But, first salvage all readily usable equipment when practical. Every reclaimed valve, for example, means that another new one is available for essential war industry—that another valve is on hand to keep production lines flowing. For practical, valuable hints on reclaiming valves, get a copy of this Crane "Piping Pointers" Bulletin No. 5.

### "Piping Pointers" Free on Request

"Piping Pointers" Bulletins help you do three important wartime jobs: (1) Train new men for piping maintenance work; (2) Get better service from piping equipment; (3) Conserve critical metals. By using these Bulletins in maintenance shops and employee training classes, as many plants are doing, you share in Crane Co.'s *basic* information—gleaned from Crane's 87-year leadership in producing valves and fittings. Just ask your Crane Representative or write direct for your supply. No obligation!

**Crane Co., 836 S. Michigan Ave., Chicago, Ill.**

# CRANE VALVES

***The whole art of teaching is only the art of awakening natural curiosity for the purpose of satisfying it afterwards*—Anatole France.**

# Speckled Apples . . .

I HAVE ALWAYS REMEMBERED the old story about the farmer who insisted that his children first bring from the fruit cellar the speckled apples—the ones about to go bad. In that way he made sure no apples were wasted, but his family spent the winter eating half-rotten apples.

We power engineers, in common with every other employer, are in the position of the farm family this winter—except that there are no good "apples." Uncle Sam is taking the young and sound men who can be spared, and we must make out with what is left. No more can we insist on tops in intelligence, skill, adaptability and physical health.

First and foremost, you can't hire a new water tender, a new fireman, or a new shift engineer. You've just got to hire a new man and try him at various jobs until you find one he can do. When you've found out, pass the present man in that job to a new one. That's "promotion from within" and it also helps to train men for more jobs—very important today when the crew may change almost overnight.

Next, don't try to make a power engineer out of the new man the first day. More potentially good men have been spoiled by being pumped over-full of strange information than by being taken along too slowly. Your first job is to get the man's confidence. Talk quietly with him about his background and experience and try to pass on to him some of your own pride and belief in your job. Most of all, don't try to impress him with your own importance—you'll only get him more ill at ease because he'll think that, on top of everything else, his new boss is a stuffed shirt.

When you put him at a job, explain it slowly and carefully. Show how it fits the whole pattern of plant operation. Answer immediate questions. Let him work as helper or buddy with your best man on that job for a shift or two. Later on, pick a responsible man on the new man's shift to watch out for him for a while.

If at all possible, set the new man to work occasionally studying and sketching a part of the plant. Let him, for example, spend an hour or two sketching the feedwater system, another on the heat exchanger, others on water column and gage glass, condensate return, and so on. This is really part of the third step in training—try-out. It gives you another chance to answer questions and point out errors or weak points. And if he's drawn it himself, the learner will remember.

Lastly, come back regularly and check up on how things are going. Coach him from time to time and taper off gradually as he shows he can work on his own.

If you'll follow this method, you can get along even if you lose a key man. After all, Engineer E G Grady put a new 13,500-kw plant into operation with only three experienced men. Manufacturers' men helped out the novices a little, and Grady did the rest himself (see POWER, Sept, 1942, page 94). Another possibility is to find some retired old timer to come back and explain things to the green men a couple of hours a day. Or even to start classes at off hours. You've got to cut your suit to fit the cloth—and Phil Swain promises me that POWER will be full of data to help on the tailoring.

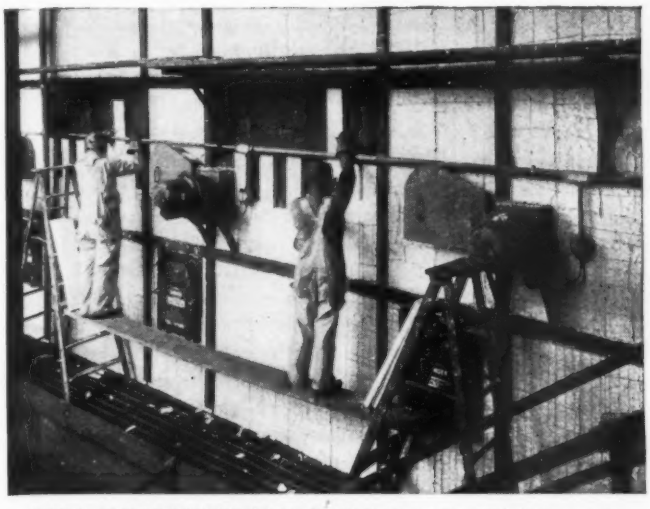
Our job today is to spend all the time necessary to pick the specks out of speckled apples, to get the good out of what's left.

George Edwards

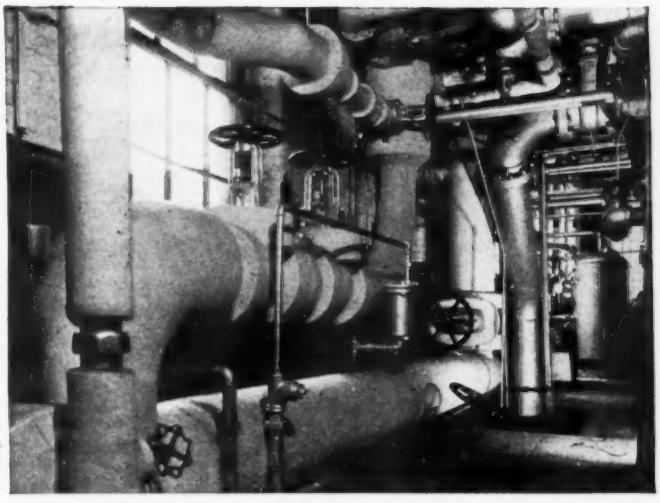
*Engineer*

## Meet wartime conservation demands with

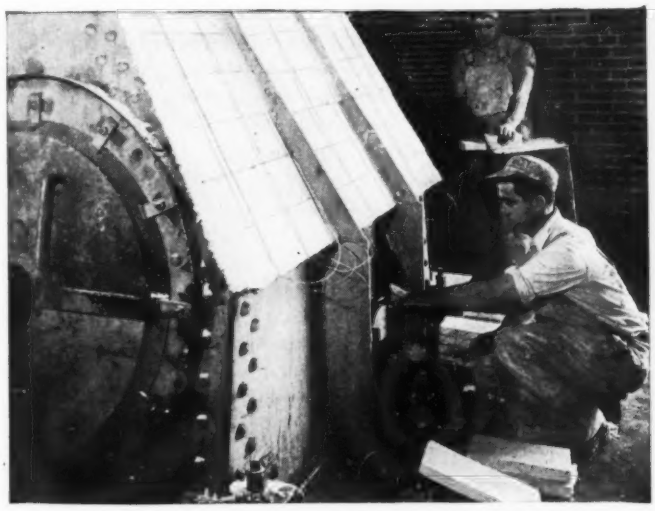
# Johns-Manville Insulations



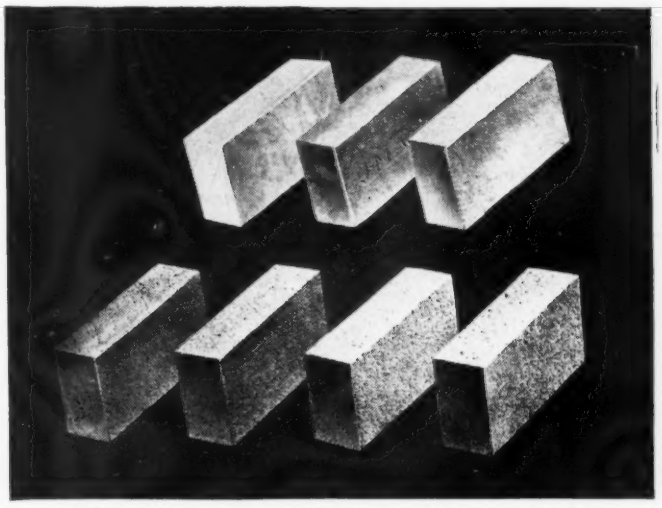
**FOR TEMPERATURES TO 600° F.** J-M 85% Magnesia has been for many years the most widely used block and pipe insulation for temperatures to 600° F. and, in combination with Superex, for higher temperatures. Maintains high insulating efficiency. Standard block sizes 3" x 18", 6" x 36" and 12" x 36"; from 1" to 4" thick.



**FOR STEAM LINES UP TO 700° F.** J-M Asbesto-Sponge Felted Pipe Insulation is recommended where maximum efficiency, high salvage and resistance to abuse are essential. For temperatures over 700°, used in combination with Superex. It is available in 3-ft. lengths, from 1" to 3" thick, for standard pipe sizes.



**INSULATION FOR TEMPERATURES TO 1900° F.** J-M Superex Blocks have long been standard for this service. High heat resistance, low thermal conductivity. Sizes 3" x 18", 6" x 36" and 12" x 36"; from 1" to 4" thick.



**FURNACE INSULATION UP TO 2600° F.** J-M Insulating Brick and Insulating Fire Brick are available in 7 types, with temperature limits ranging from 1600° F. to 2600° F. All provide light weight, low conductivity.

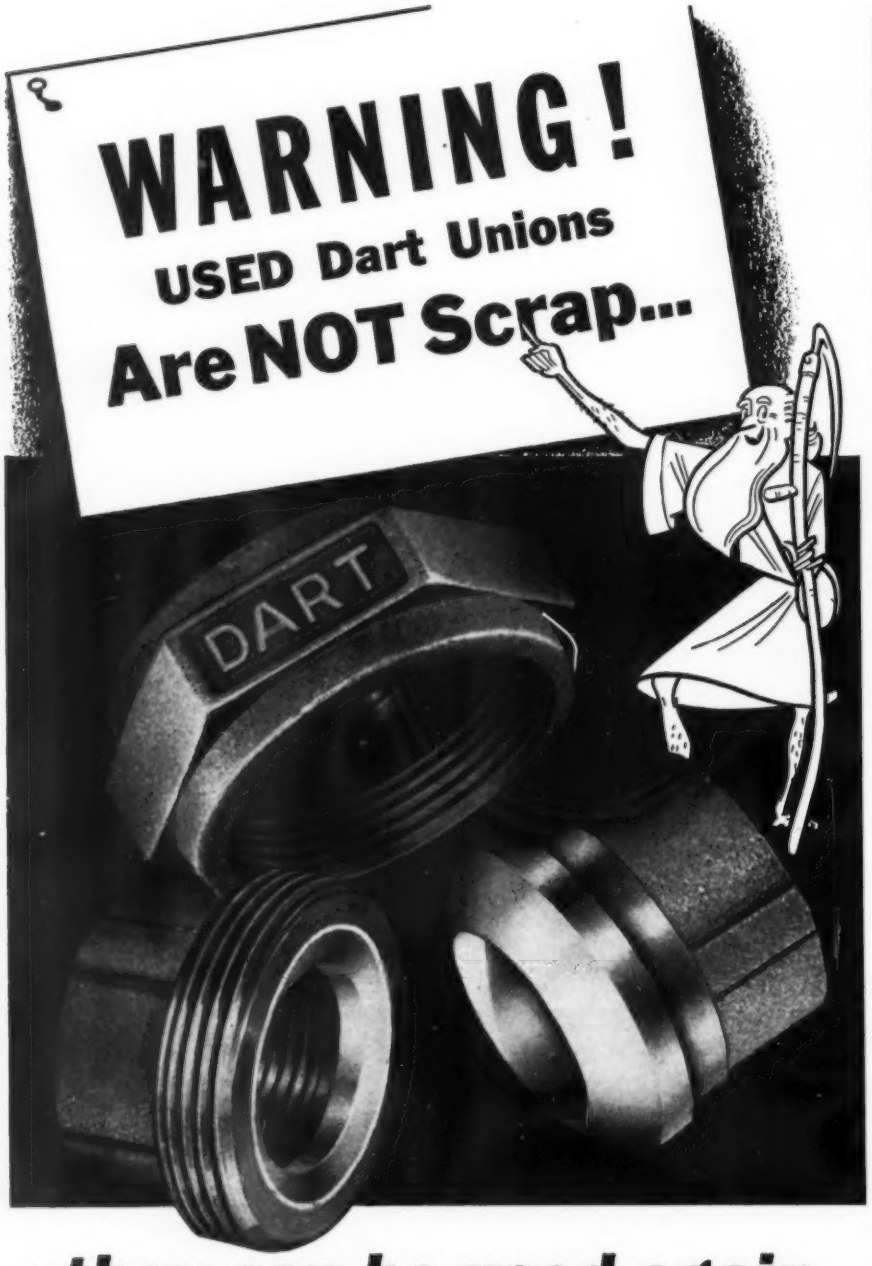
# JOHNS-MANVILLE

## Industrial Insulations

*FOR EVERY TEMPERATURE . . . FOR EVERY SERVICE*

**FOR DETAILS** on these materials, and on the complete J-M Insulation line, write for Catalog GI-6A. Johns-Manville, 22 East 40th Street, New York, N. Y.

JOHNS-MANVILLE JM PRODUCTS




# they can be used again

Every little bit of scrap counts for Victory. But by junking equipment that is needed and can be used again—such as used Dart Unions—you actually *delay* Victory. So don't throw away old Darts—put them back to work.

Know *why* Dart Unions can be used so many times, with such tight-joint performance—after ordinary unions have to be discarded? Darts have matched bronze seats, ground to true-ball surfaces for correct, leak-proof seating . . . clean-cut threads that prevent scoring . . . extra-heavy bodies and nuts made from air-refined malleable iron that withstands rough handling.

Your old Darts and new Darts make a great team. *Use* your old ones . . . see your supplier for new ones.

DART UNIONS

**E. M. DART MFG. CO., PROVIDENCE, R. I.**

## Forced-Air Layouts

(*Continued from page* 78)

Proper zoning also allows for differences between internal and external spaces on the same system. With installations of this type, difference between summer and winter conditions becomes large. In summer, the *sum* of internal and external loads forms the cooling or refrigeration load, but in winter the *difference* between external and internal loads forms the heating load. Because internal loads sometimes constitute the greatest part of the refrigeration load, external and internal spaces may be combined successfully on some jobs, for summer operation only. This is never true of winter operation, for the external spaces form practically the entire heating load and if on the same zone, internal spaces would be overheated.

Fig. 4 shows an actual installation where private offices with little internal load made up the external spaces and the internal spaces carried a high population load. In summer, this job worked well because there was enough load in both internal and external space to obtain a good balance. In winter it was necessary to overheat the internal spaces to supply enough heat to the exposed spaces. The cure involved installing a booster heater at *A* with sufficient capacity to supply the heat load of the external spaces. The internal spaces received tempered air for ventilation. The best solution would require running a separate duct to supply the external spaces, thus zoning them from the internal space. This would also yield better summer operation.

In addition to zoning external spaces separately from internal spaces, for winter heating, provision must often be made for simultaneous heating of one space and cooling of another. This need usually arises in intermediate-season operation. For example, shaded external zones may require heating at times when those exposed to sun require some cooling. This means supplying heat individually to each zone so that one zone may be cooled with outside or refrigerated air while another is being heated. This cannot be done at the main fan supplying all zones because a demand for heat in one zone results in supplying some heat to every zone.

On jobs having a booster fan in each zone, intermediate-season heat should come from the booster, thus allowing cool outside or refrigerated air from

It's just horse sense that a "horsepower" Steam Turbine sized right for the job saves metal for war and money for you while an "Elephant Power" Turbine too big for the job wastes both. COPPUS Blue Ribbon Turbines come in six frame sizes from 150 H. P. down to fractional. Each smaller size requires less metal and is priced less. The "Blue Ribbon" certifies prize-winning COPPUS performance.

## COPPUS TURBINES

***Save Metal in Wartime — Will Save You Money in Peacetime***

Like all Coppus "Blue Ribbon" Products (blowers, ventilators, gas burners, etc.), the Coppus steam turbine is a precision-made product . . . controlled by Johansson size blocks . . . and every turbine is dynamometer-tested before shipment. More than 85% of all orders since 1937 have been repeat orders.

Write for Bulletin 135-9

**COPPUS ENGINEERING CORPORATION**
301 Park Avenue, Worcester, Mass.

Sales Offices in THOMAS' REGISTER
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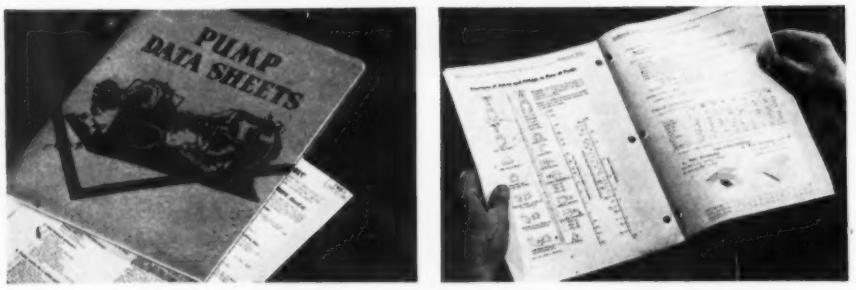
COPPUS

BLUE RIBBON PRODUCTS

DESIGNED FOR YOUR INDUSTRY . . . ENGINEERED FOR YOU

# THESE FREE PUMP DATA SHEETS

## SHOW HOW TO CHOOSE . . . INSTALL . . . OPERATE AND MAINTAIN INDUSTRIAL PUMPS MORE EFFICIENTLY




Here is your chance to get a free portfolio of Goulds Pump Data Sheets, containing a host of facts and pointers on more efficient pumping. You'll find the binder extremely helpful, with easy-to-follow diagrams, tables, charts and formulae—valuable tips on getting the most out of your pumps for the duration.

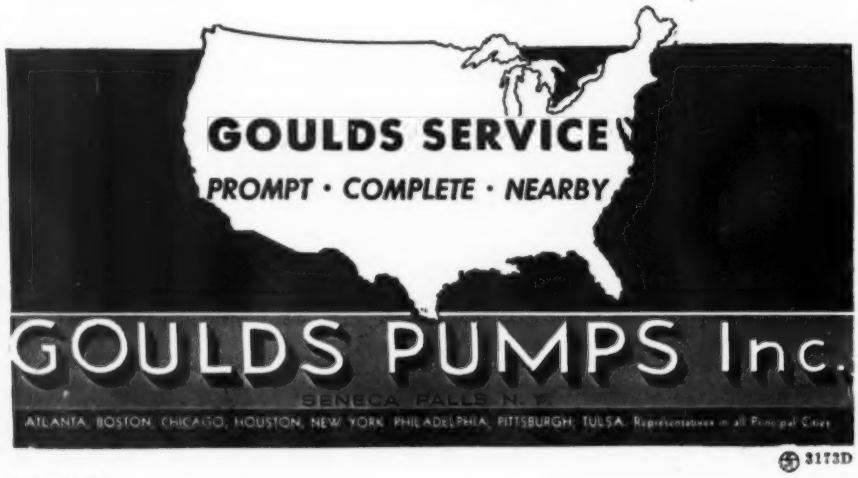
Elementary subjects are covered simply and clearly, to speed the training of new men for their jobs. Advanced technical data are liberally included to guide you over the tight spots in pump selection, installation, operation and maintenance. The material deals with all types of pumps, not only Goulds. Each set is durably bound, with an extra pocket for your own notes.

These sheets were originally intended for confidential use by Goulds own salesmen. Much of the material included has never before been made public. We offer this portfolio now in a spirit of all-out helpfulness to pump owners in time of war.

As a first step, write for one binder. If, after receiving it, you wish extra copies of any sheet, booklet, or the entire set, we shall be glad to send them to you. Address all requests to Dept.—T.

*These valuable folders included!*

- "Pump Trouble Check Sheet"—2-page list of symptoms and cures—centrifugal, reciprocating, rotary.
- "Priming Methods"—4-page folder describing eight best methods for priming centrifugals.
- "Hydraulic Data"—8-page reference folder of definitions, tables, formulae—heads, pipe and fittings friction, etc.
- "New Pump vs Old Pump"—2-page sheet showing how to figure operating costs, correct pipe sizes, etc.
- "Boiler Feeding & Hot Water"—8-page pamphlet telling how to figure capacities, heads, select proper pump, etc.
- "Centrifugal Boiler Feed Pumps"—4-page folder of instructions, tips on operation and maintenance for best performance.
- "Pump Fundamentals"—18-page elementary handbook on types of pumps, uses, and installations.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the main supply fan to be supplied to zones needing cooling. The booster heaters may be large enough to take care of the entire load or only of sufficient capacity to handle the intermediate-season load with a reheater at the main fan to take care of peak loads.

Jobs not equipped with booster fans should be provided with booster heaters in branch ducts supplying each zone.

A special case involving simultaneous heating and cooling in the same space sometimes occurs in department stores or other spaces where a heavy lighting and population load may require cooling in the center of the space while at the same time heating may be required along exposed walls. Booster heaters in branch ducts supplying air to the exposed walls, or direct radiation solve such problems, allowing cool air in the main ducts to care for the refrigerating load in the center.

Tall buildings form still another special case of zoning. Floors should be isolated at various elevations not more than ten floors apart to prevent induced flow of warm air upward through vertical openings such as stairwells or elevator shafts. If this is not done, it may be difficult to heat lower floors properly and to avoid uncomfortable drafts caused by excessive infiltration at lower levels.

If floors are isolated so that there is no chimney effect, upper floors need more heating capacity on the windward side, which must be zoned from the leeward side.

Finally, zoning must allow for difference in conditions of occupancy. Areas with high internal peak loads of relatively short duration, such as cafeterias and assembly rooms, should be zoned separately from areas having a more steady load. Likewise, areas with large internal loads caused by lighting and population, but with different periods of occupancy, should be zoned separately. Otherwise adequate heating of one space when unoccupied might result in overheating of the occupied space.

## Conversion at Scott

(*Continued from page* 75)

to three motor-driven 5-ton-per-hr pulverizers. Both pulverizers and motors were purchased secondhand. Pulverizers discharge to cyclones from which the coal is carried to a hopper at the end of the pulverizer house by two

# Add Them to Your Check List of Safety Measures

✓ Fire-alarm Systems
✓ Fire Walls
✓ Sprinkler Systems
✓ Pyranol Transformers

## ...Because Pyranol Cannot Burn

**FROM THAT ONE FACT SPRING MANY BENEFITS:**

✓ YOU CAN INSTALL THEM INDOORS *SAFELY:* No Pyranol transformer has ever burned or contributed to a fire. Even if heat from a surrounding blaze ruptures the tank, the fire hazard will not be increased.

✓ VAULTLESS INSTALLATIONS ARE POSSIBLE: You can install them indoors or outdoors —in the basement, on the factory floor, on overhead beams, or on the roof. Such flexibility assures you major savings in time, floor space, and construction materials.

✓ PRIMARY POWER CAN BE RIGHT AT THE LOAD: Voltage regulation is improved, line losses are lowered, copper is saved—often up to 30,000 lb in large industrial installations.

**AND BECAUSE THEY ARE *LIQUID-FILLED* THEY HAVE:**

✓ — —A HIGH, *LASTING* DIELECTRIC STRENGTH—an important safeguard against damage from voltage surges caused by lightning and switching

✓ — —PRESSURE-TIGHT TANKS, which protect vital parts from dust, dirt, and sabotage

✓ — —A HEAT-STORAGE CAPACITY that is ideal for emergency overloads

PYRANOL* transformers fit naturally into your wartime campaigns for (1) safety, (2) stepped-up production, and (3) conservation of critical materials.

The absence of fire hazard will help you with campaign No. 1. A reliable power supply, easily installed *where you want it*, is an important consideration for No. 2. Fireproof vaults being unnecessary, vital construction materials are saved. Since Pyranol transformers can be located at the load center, the runs of secondary copper are greatly reduced. These are important factors in helping you with point No. 3.

Since the introduction of Pyranol, in 1932, more than 4,000,000 kva of new transformers have been built using this type of cooling and insulating liquid. Hundreds of users are finding that Pyranol transformers assure the lowest total installed cost commensurate with the highest degree of safety.

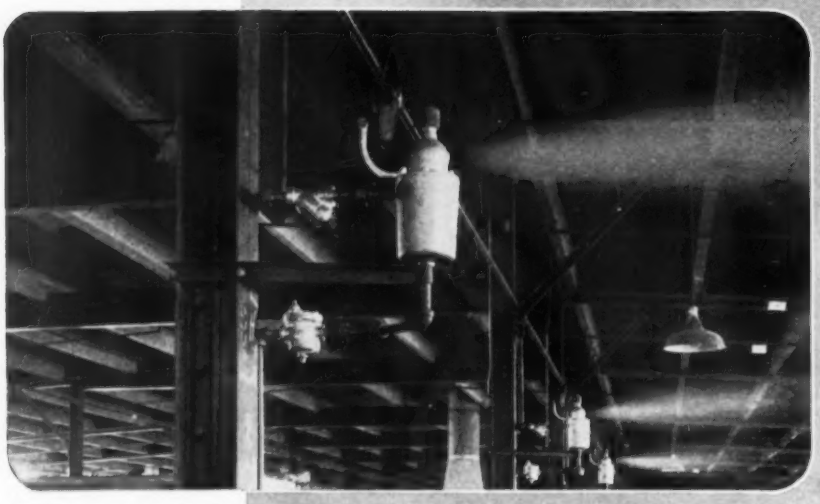
Ask your G-E representative for the complete story, or write for Bulletin GEA-2048D. *General Electric Company, Schenectady, N. Y.*

**Pyranol is the G-E trade name for askarel.*

*The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in six plants manufacturing naval equipment*

GENERAL ELECTRIC

# Dry Air Robs Output



**HERE ARE A FEW** of the many plants using Armstrong Steam Type Humidifiers:

- Amherst College
- Bemis Bros. Bag Co.
- Morton Salt Company
- R. A. F. Hangars
- Wheeler-Van Label Co.
- U. S. Rubber Co.
- Philco Corp.
- Northern Furniture Co.
- Eagle-Ottawa Leather Co.
- Remington Arms Corp.
- Van Raalte Co., Inc.
- Culver Aircraft Corp.
- S. D. Warren Co.
- Ohio Brass Co.
- Hammermill Paper Co.
- Stanley Chemical Co.
- Bauer & Black
- Davis Cabinet Co.
- Simplex Shoe Co.
- Elite Laundry
- Belding Corticelli Ltd.
- Atlas Powder Co.
- Phelps-Dodge Corp.
- Sakura Silk Co.
- E. Ingraham Clock Co.
- Dixie Mercerizing Co.
- Dunlop Tire & Rubber Corp.
- Agfa Ansco
- The Dow Chemical Co.
- Curtis Publishing Co.

**WRITE TODAY**

*for free copy of new bulletin "Armstrong Humidifiers for Industry". It tells how Armstrong Humidifiers are being used advantageously in practically every industry for a wide variety of applications.*

## Use ARMSTRONG *Steam Type* HUMIDIFIERS

***Here's What They Will Do For You —***

1. **PREVENT loss of weight, strength or quality of hydroscopic materials.**
2. **IMPROVE workability of materials.**
3. **CONTROL troublesome or dangerous dust and static conditions.**
4. **PROVIDE healthier working conditions.**
5. **CONTROL drying processes.**

DRY air causes fiber breakage in textile mills, warping and checking of wood, shrinkage of paper, excessive static electricity, spoilage of certain foods, cracking of leather, loss of weight, excessive dust and many other evils that cut deep into wartime output.

Hundreds of leading plants in all types of industries are using Armstrong Humidifiers to stymie the dry air nuisance. They are low in cost—small units such as those illustrated above list for only $100 complete with sensitive Friez humidistat and all accessories. Capable of handling up to 40,000 cu. ft. of space and more. Connected into existing steam lines and electrical circuit—as simply as unit heaters. Ask for literature on this practical method of humidification today.

**ARMSTRONG MACHINE WORKS**
**812 Maple Street • Three Rivers, Michigan**

BUILT BY THE MAKERS OF ARMSTRONG STEAM TRAPS


parallel conveyors. A 100-ton pulverized-coal silo is also provided.

A 1324-cfm compressor, driven by a secondhand motor, provides air for pulverized-coal transport to the boiler house. Calculations show that 10 cfm of free air per ton will move coal 500 ft and 17 cfm are required for 800 ft. The transport line discharges into two 30-ton silos above the boiler house, which in turn lead down to the burners.

Before the present boilers were installed, a row of stoker-fired units occupied this part of the boiler house. The ash-removal tunnel for these boilers still exists and will be used for an ash conveyor discharging into a proposed 60-ton silo to be located on the river side of the plant.

### *Original Plans*

Original plans called for reinforced-concrete construction of the pulverizer house and silos, but this was abandoned in favor of heavy timber construction because of the critical materials involved. Before construction could begin, timber was also placed on the critical list so that construction again had to be revised to call for silos and other structures of tile. Metal and other critical materials will be used only for transport line and conveying equipment. The transport line also represents a change from the originally proposed conveyor which required far greater amounts of critical materials.

While this entire conversion has been undertaken as a temporary expedient, it will represent an investment of $400,000. Because no spare equipment is provided, it does not offer full reliability but it is expected that some oil will be available for emergencies.

## Argument Corner

(*Continued from page* 132)

foregoing design may be adapted for economical 120-208 volts. This may further be extended to the use of 2300-volt motors when the individual motor size runs to hundreds of horsepower. The in-between stage (440-volts) seems unwarranted by the mere fact of introducing a characteristic so uncommon as to place the equipment in a "special" class.

To sum up, the most logical general guide appears to be: all lamps, 115-120 volts; motors up to and including ¼ hp, 115-120 volts single phase; motors above ¼ hp, 3 phase 208 volts (220-volt motors are adaptable). Extra large motors, 3 phase 2300 volts. Just where this use of 2300 volts should start

# Scovill Tube News

Vol. 1 SCOVILL MANUFACTURING COMPANY, Waterbury, Conn. No. 1

# Factors Affecting War-Time Efficiency of Condenser and Heat Exchanger Tubes

## Introduction

The widespread use of copper and copper alloys in heat exchanging equipment is due in some measure to the many favorable physical properties of these materials, i.e., their ductility, toughness, strength, high thermal conductivity, etc., over a wide range of temperatures and pressures. The excellent corrosion-resistance of the copper alloys under most operating conditions, however, is of major importance in this application. The ability of copper and its alloys to withstand the corrosive action of such media as fresh and salt waters, sewage, hydrogen sulphide, acids, alkalis, etc., is of a high order and has established their value in tube form in contact with corrosive media. They have proved their dependability and economy under such conditions as well as under wide fluctuations of temperature, pressure and velocity of the circulating media.

Serious corrosion of condenser and heat exchanger tube does occur, however, particularly when corrosive conditions are admittedly very severe and such corrosion may result in considerable expense, costly delays and shut-down of equipment. In many cases, no improvement in tube life can be expected under existing conditions; in other cases, however, it has been possible to reduce or retard corrosion materially and obtain improved tube performance either by slight changes in operating conditions, by attention to certain operating details or by a change from one tube alloy to another which is more corrosion-resistant to the particular service conditions. For this reason, an appreciation of the factors which contribute to corrosion of tube materials is often of value to a better understanding of corrosion problems; this knowledge, in turn may be used to advantage in combatting such problems and in improving tube life. The subject is considered of sufficient importance to tube users to warrant discussion of the more important matters pertaining to corrosion problems.

**Limitation Order L-154 issued by the O.P.M.**
This order limits the use of non-ferrous condenser tubes in land power stations to Muntz metal for fresh water plants and Admiralty metal for salt water plants. No non-ferrous metals containing more copper and more tin than these two are permitted by the order.

## New War-Information Service to Save Scarce Tube Metals

First in a continuing series of informative bulletins on condenser and heat-exchanger tubes, the article on this page is part of Scovill's Service in Manuals available without charge to all tube users. Reprints of each numbered article are available on request and will form a new, complete "Condenser Tube Booklet" including conditions of service, types of corrosion, and selection of materials. Write Scovill Manufacturing Company, 13 Mill Street, Waterbury, Conn.

## Factors Affecting Tube Life

The service life of condenser and heat exchanger tubes is governed by the following major influences:

1. the composition of the alloy
2. the workmanship and quality of the tubes
3. the conditions of service of the tubes

The most satisfactory tube service and tube performance in a heat exchanger unit is obtained only after a careful consideration of these factors. Some discussion is therefore devoted to each of them.

### *1. The Composition of the Alloy*

The non-ferrous alloys for heat exchanger service may be grouped into three broad classifications, as follows:

(a) Copper, Phosphorized Copper and Arsenical Copper

(b) Brasses or Copper Zinc alloys, usually containing small percentages of other metals such as Tin, Aluminum, Nickel, Iron, Lead, etc.

(c) Copper Nickel alloys, containing Copper, Nickel and, in some cases, minor amounts of other elements such as Tin, Iron, Manganese, Zinc, etc.

Most of the tube alloys carry trade names which usually identify them, as for example, muntz metal, naval brass, admiralty metal, red brass, aluminum brass, etc. The choice of any particular alloy for a particular service is based on the known behavior of such alloys under any definite set of conditions, on previous service experience of tubes in the unit in question or similarly operated units, and on the type or form of corrosion which predominates. It may be pointed out, by way of illustration, that copper and alloys of high copper content (85% or over) are not generally recommended for service where corrosion by hydrogen sulphide or similar sulphur compounds is known to be severe; likewise, muntz metal and other alloys of brass high in zinc content (which contain no inhibitive agent) are not serviceable under conditions where serious dezincification may be experienced. On the other hand, tubes of aluminum brass or copper-nickel withstand mechanical abrasion or erosion-corrosion better than other alloys.

This subject is further discussed in a later issue of "Tube News".

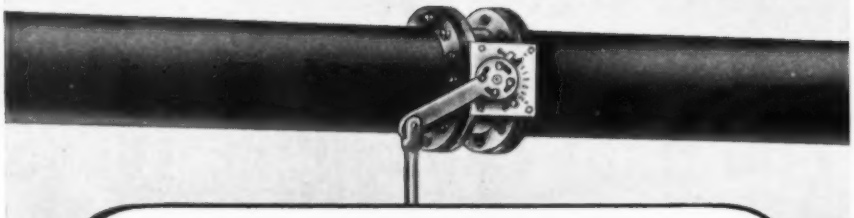
Scovill MANUFACTURING COMPANY WATERBURY, CONN

SCOVILL CONDENSER TUBES

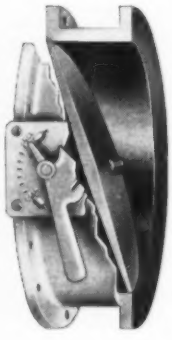
*ONE PRODUCT... THREE SERVICES*

Service in Manuals... Service in Metals... Service in Men

# Uniform Pressure Obtained in Inaccessible Line



Uniform pressure is obtained on the downstream side of an R-S Butterfly Valve in an inaccessible line by means of an extended reach rod and an electric motor. The declutching unit and hand wheel control is used when the power fails. Can be powered by an air diaphragm motor or hydraulic cylinder.



As the illustration indicates, the beveled vane closes naturally against the body of the valve and at the correct angle for the wedge-tight shut-off of any material that flows or is forced through a pipe. Machined to exceptionally close tolerances.

Streamlined construction induces self-cleaning Maintenance is no problem —constructed to last for years. Sizes to 84-inches and pressures to 600 pounds.

Write for catalog, approximate weights and detailed dimensions.

BUTTERFLY VALVE DIVISION

**R-S PRODUCTS CORPORATION**

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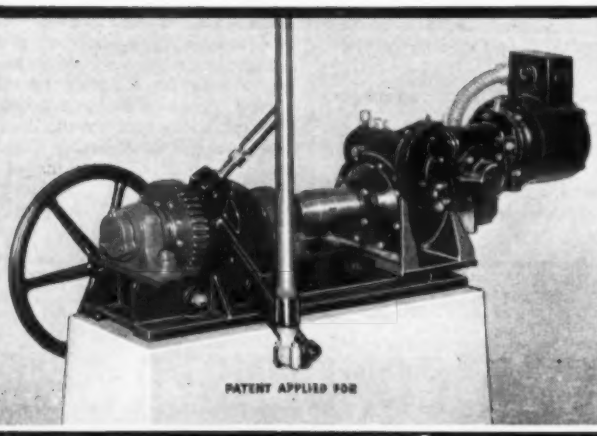


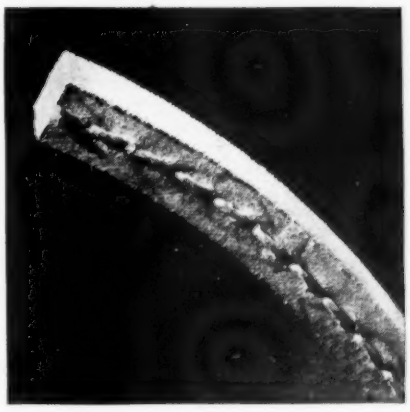

R-S Streamlined BUTTERFLY VALVES


is a matter for individual study on each project.

*Falls Church, Va.* L C Runyon

## Soaking Packing Before Using

Soaking hard dry square pump-piston packing in hot water as recommended by Alex Gray (Power, Aug 1942, pg 113) has an advantage other than those mentioned by Mr Gray. During my learning days on pumps I packed a brass piston with four rings of 3/8-in. square packing and tightened the follower ring snug. The pump went into service and the packing began to expand when it came in contact with hot water. As there was no place for the increased volume of packing to go it



broke the follower ring off the piston. Therefore, swell the packing in hot water as recommended by Mr Gray before you put it on the piston and then tighten up the follower rings as snug as you think best.

On our pump piston I use a laminated fabric and rubber packing. Years ago when I first started to use this packing the laminations had a tendency to separate because of water leaking past the piston. Shreds of the fabric in the packing broke off and gave trouble by lodging under valves and preventing them from seating properly. The packing manufacturer overcame this difficulty by sticking the packing at right angles to the laminations, as in the figure. This not only eliminated the trouble with the packing but materially increased its life.

*Vancouver, B. C.* R Manley Orr

## Thread Chaser Had Wrong Angularity

G Barrett described a method for chasing the thread on a fan shaft (Power, Oct 1942, pg 116). This ob-

Diagnosis and preventive measures are not limited to the activities of the medico. The Betz organization has been applying these principles in the field of industrial water conditioning for many years . . . and the results obtained have borne out the soundness of a scientific approach.

Water, which can truly be called the common denominator of all industry, is seldom suitable for use in its natural state. It is our function to assume the responsibility for protecting industry from the many hazards which accompany the use of incorrectly or inadequately conditioned water for boiler, cooling, and process uses . . . and in the handling of problems of industrial waste and sewage disposal.

We have laboratories and engineers located throughout the United States and Canada.

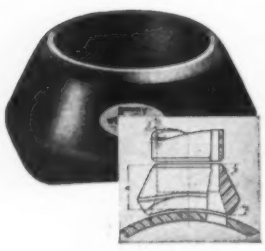
**W. H. & L. D. BETZ**

**FRANKFORD • PHILADELPHIA • PENNA.**

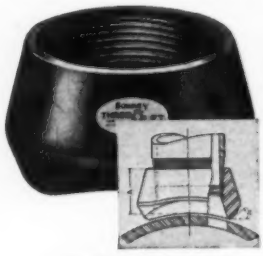
CHEMICAL ENGINEERS AND CONSULTANTS ON ALL WATER PROBLEMS

# Speed up branch outlet installations without removing the main pipe

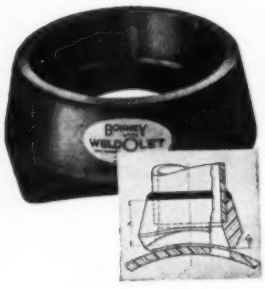
## These are the fittings that do it



WELDOLET



THREDOLET



Socket-End WELDOLET

BECAUSE 90° welded, right-angle branch pipe outlets are made with WeldOlets, ThredOlets and/or Socket-End WeldOlets without any threading, forming and fitting of the main pipe, installation of branch lines is speeded up and cost of installation reduced. Because of their design and ease of application, their installation on existing lines is in many cases possible without even removing a section of the main pipe.

They provide leakproof junctions of full pipe strength, that reduce turbulence and friction to a minimum. Available from stock of drop forged steel for all standard pipe sizes to 12" x 12"—and on special order up to 24" x 24". For special applications they can be furnished in Monel, Everdur, Toncan Iron, wrought iron, etc.

## They are easily installed

Mark center lines. Tack the fitting into place. The fitting is the templet.

Then weld the fitting to the main pipe.

Removal of the button permits inspection of the inside of the joint, impossible with any other fittings.

Then attach the branch pipe. A trim, leakproof junction of full pipe strength results.

## This book tells how

It tells in detail: their purpose; what they are; how to make welded, right-angle branch pipe outlets stronger, better and at less cost; how they reduce turbulence and friction; how to make a right-angle outlet in six easy steps; how they fill every piping need for new construction or maintenance; their adaptability to shop fabrication, as well as complete tables of specifications and dimensions.

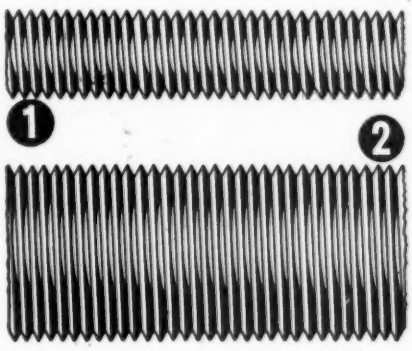
If you use or expect to use pipe fittings for welding, you need this book. Write for it today . . . Bulletin WT31.

**BONNEY FORGE & TOOL WORKS, Allentown, Pa.**

WELDOLETS·
TRADE MARKS - REG. U. S. PAT. OFF.
THREDOLETS
*Welded Outlets for Every Piping System*


viously proved to be a workable makeshift in the absence of the necessary equipment for doing the job properly. However, lest others try using this method where a more exact one is required it should not be overlooked that for the chasing tool to produce clean threads of the same angle as the mating nut, the chasing tool must have the same thread characteristics as the nut.

Mr Barrett used a standard 1-in. tap with eight threads per inch to make the thread chaser. Obviously the angularity of the thread in the chaser was greater than that on the 2-in. shaft threads, as




indicated in Fig. 1 and 2. In both figures the number of threads per inch are the same, but Fig. 2 has twice the diameter of Fig. 1. An exaggeration of this would be where a chaser formed with a 1-in. tap was used to clean up the threads on a 10-in. shaft that had eight threads per inch. Such a chaser would produce a thread substantially below the necessary thickness at the root.

In conclusion, your readers should be reminded that the resourcefulness of Mr Barrett proved practicable only because the job required no precision. Careful consideration of the circumstances should be given any similar job before this method is used. In these days short cuts designed to save time must not imperil equipment that cannot be readily replaced.

*Scarsdale, N. Y.* ROBERT S HACKETT

# New Power Construction

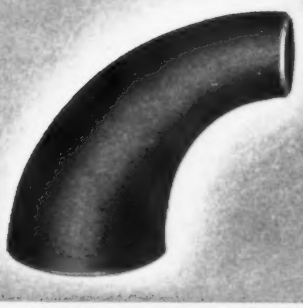
## Construction to Come

**Alabama**—War Dept, 20 St, and Constitution Ave, N W, Wash., D. C., plans constructing bldgs, Etowah Co, $5,000,000.

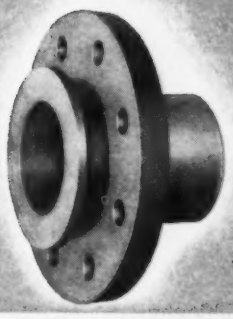
**Arkansas**—U. S. Eng, 300 Bway, Little Rock, plans constructing bldgs. $1,500,000.

**California**—Bureau Reclamation, Custom House, Denver, Colo., cancelled bids to have been opened Nov 2, furnishing pier-nose columns, etc, Keswick Power Plant, Kennett Div, Central Valley Project, Spec 1672.

AMERICAN STANDARD BUTT-WELDING ELBOWS



REDUCING BUTT-WELDING ELBOWS



LAP-JOINT STUB ENDS

"LONG TANGENT" BUTT-WELDING ELBOWS

BUTT-WELDING REDUCERS

# MIDWEST

# WELDING FITTINGS

## *SAVE TIME*
## *IMPROVE PIPING DESIGN*
## *REDUCE COSTS*

Many qualified welders who have worked on all kinds of piping jobs will tell you that Midwest Welding Fittings have exceptional dimensional accuracy and uniformity . . . saving time in layout because all pipe can be cut in advance according to drawings . . . saving time in lining up and welding . . . assuring more uniform welds.

Midwest originated and developed many of the fittings shown here: the "long tangent" elbows, saddles, sleeves, shaped nipples, and lap-joint stub ends with large radius and heavy forged lap. Midwest Saddles compensate for the weakening of header body resulting from the metal removed for neck opening; Midwest Sleeves relieve butt welds of any bending stress and much of tensile stress; Midwest Shaped Nipples eliminate all layout and templates when saddling one pipe upon another; etc. Get Bulletin WF-41 for complete information.

**MIDWEST PIPING & SUPPLY CO., Inc.**

Main Office: 1450 South Second St., St. Louis, Mo.

Plants: St. Louis, Passaic (N.J.) and Los Angeles

Sales Offices: Chicago—645 Marquette Bldg. • Houston—229 Shell Bldg. • Los Angeles—520 Anderson St. • New York—(Eastern Division) 30 Church St. • San Francisco—535 Call Bldg. Tulsa—533 Mayo Bldg.

BUTT-WELDING CAPS

BUTT-WELDING TEES

BUTT-WELDING CROSSES

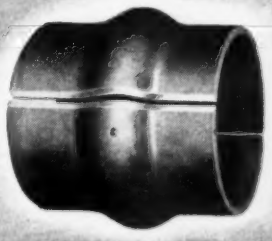
BUTT-WELDING TEES REDUCING ON RUN

WELDING SADDLES

BUTT-WELDING RETURN BENDS

SHAPED NIPPLES

FORGED STEEL FLANGES



WELDING SLEEVES

# FLEXPEDITE

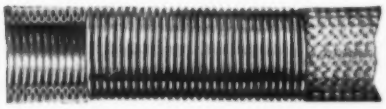
**Your Conversion—Assembly—Production**

**with**

# REX-WELD

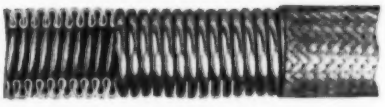
## Flexible Metal Hose

Rex-Weld Hose—Annular Corrugations



RW-80 Unbraided ——— RW-81 Braided

Rex-Weld Hose—Helical Corrugations



RW-90 Unbraided ——— RW-91 Braided

### —General Data—

| | STEEL | BRONZE |
|---|---|---|
| Sizes | To 4" I.D. | To 4" I.D. |
| Pressures | To 14,500 p.s.i. | To 14,500 p.s.i. |
| Temperatures | To 1000° F | To 450° F. |
| Lengths | To 50′ | To 50′ |

### —Use Chart—

| | *STEEL | BRONZE |
|---|---|---|
| Saturated Steam | | ✓ |
| Superheated Steam | ✓ | |
| Sulphur Bearing Oil | ✓ | |
| Oxygen | | ✓ |
| Ammonia | ✓ | |
| Carbon Dioxide | ✓ | |
| Sulphur Bearing Grease | ✓ | |
| Critical Vibration | | ✓ |
| Non-Sparking | | ✓ |

*Protective Coatings Can Be Applied for Corrosion Protection (To Conserve Critical Copper Bearing Alloys).*

**Couplings: REX-TITE Mechanical (Re-attachable) Couplings; Solder Couplings; Brazed and Welded Couplings and Flange Assemblies for Rex-Weld Flexible Metal Hose.**

*Ask for Engineering Recommendations*

## CHICAGO METAL HOSE CORPORATION

General Offices: MAYWOOD, ILLINOIS

*Factories: Maywood and Elgin, Ill.*


**Conn., Cos Cob**—New York, New Haven & Hartford R R, E E Oviatt, ch engr, Water St, New Haven, plans constructing imprv power plant, new boiler included. $500,000. Gibbs & Hill, Inc, Penn Station, New York, N. Y., structural engr.

**District of Columbia**—Bids about Jan. 1, by U. S. Eng, McMillan Station, Dalecarlia, constructing pump sta, $918,000, gravity main Dalecarlia, $671,000, Fort Reno reservoir, $500,000.

**Ill., Aurora**—City, D D Ricker, clk, plans constructing imprvs, $1,200,000 CAA.

**Iowa, Cedar Rapids**—Maude M Krebs, city clk, bids soon, constructing imprvs., $900,000.

**Kansas**—U. S. Eng, Albuquerque, N. M., plans constructing imprvs, Seward Co, $3,000,000. Wilson & Co, Salina, engrs.

**Kansas**—U. S. Eng, 416 Wright Bldg, Tulsa, Okla., plans constructing imprvs, bldgs. Under $1,000,000. Overend & Boucher, Brown Bldg, Wichita, archts.

**Maryland** — Defense Plant Corp, 811 Vermont Ave, N W, Wash., D. C., plans constructing plant. Over $1,250,000. Maryland Sanitary Manufacturing Corp, 4500 E Lombard St, Baltimore, will operate.

**Nev., Boulder City**—Bid Dec 7, by Bureau Reclamation, Custom House, Denver, Colo., furnishing gate valves, Boulder power plant, Boulder Canyon, Inv G-23, 352-A.

**North Carolina**—U. S. Eng, Durham, plans extending existing facilities enlarging bldg, Granville, Person, and Durham Counties. $1,976,199.

**Tex., Palacios**—U. S. Eng, 25 St and Avenue F, Galveston, plans constructing imprvs. Over $1,000,000.

**Tex., Pampa**—U. S. Eng, 416 Wright Bldg, Tulsa, Okla., plans expansion imprvs. Over $1,000,000.

**Va., Williamsburg** — Federal Works Agency, 606 State Planters Bank Bldg, Richmond, plans constructing 2,500,000 gal storage reservoir. Waller Mill Dam, near Magruder; low-head dam across Chickahominy River, just below intake of pump sta for pipe line now under construction to create smaller reservoir, and installing subsidiary pipelines, appurtenances. $1,081,000. Newsom & Aldrich, 500 5 Ave, New York, N. Y., engrs.

**Wis., Marinette** — Marinette Maritime Corp, plans by Max Hanisch, Stephenson Bldg, constructing boiler house.

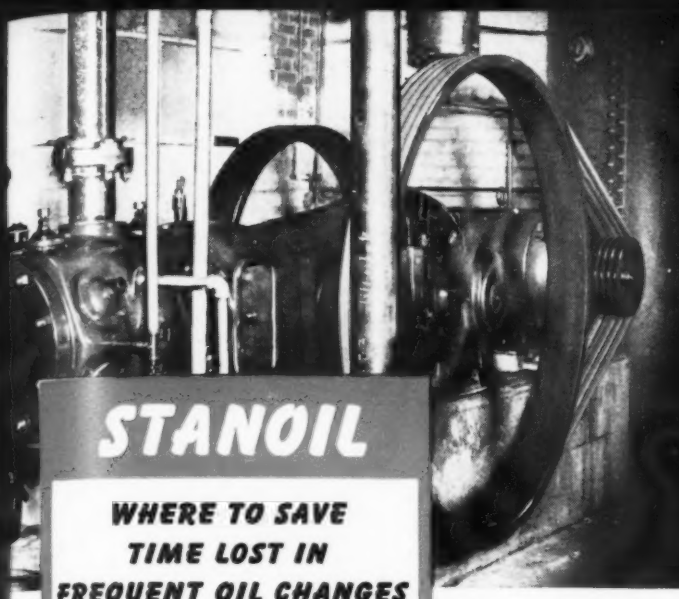
**Pacific Northwest**—U. S. Eng, 800 3 Ave, Seattle, Wash., plans constructing bldgs, Inv 262; storage rooms and refrigerators, Inv 257-9; electrical distr sys, Inv 260; bldg Inv 266.

## Contracts Let

**Alabama**—Defense Plant Corp, 811 Vermont Ave, N W, Wash., D. C., awarded contract for construction - management plant, to Bechtel-McCone-Parsons Corp, 601 W 5 St, Los Angeles, Calif. Over $12,500,000.

**Alabama**—U. S. Eng, Estaboga, awarded contract constructing water and sewage sys, pump station, treatment plant, water lines, etc, Talladega Co, to Oliver-Wilder Co, 709 Pinson Rd and Verusini Constr Co, Martin Bldg, both Birmingham. Est. $250,000.

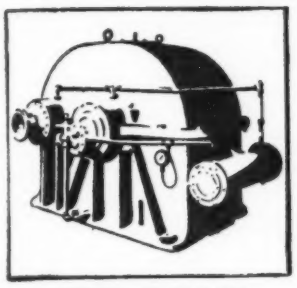
**Alabama**—U. S. Eng, U. S. Courthouse, Mobile, awarded contract constructing imprvs, Mobile Co, to Foster & Creighton Co, Amer. Natl Book Bldg, Nashville, Tenn., $500,000-$1,000,000.



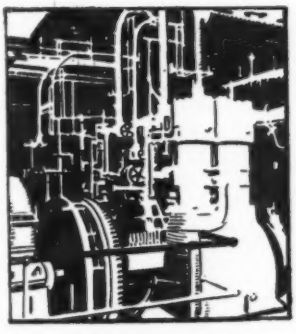
# HOW TO GET MORE PRODUCTIVE TIME FROM MACHINES

## STANOIL

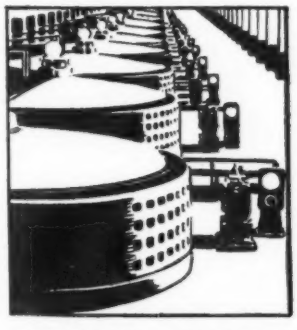
### WHERE TO SAVE TIME LOST IN FREQUENT OIL CHANGES



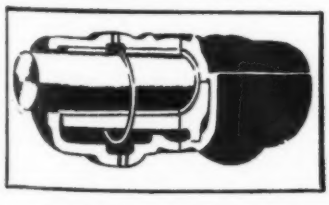
SPEED REDUCER



REFRIGERATING COMPRESSOR



HYDRAULIC TURBINE



RING-OILED BEARING

# . . . LESS "TIME OUT" FOR CHANGING OIL

FIGURE the machine time lost and man hours of labor required to change oil in a gear case, circulating system, or compressor. Multiply this by all equipment of this type in your plant. Add the time required to clean many of these units. You'll find the lost productive time well worth trying to save. Here's what you can do:

## MAKE THIS THE FIRST STEP

Make a test of Stanoil in just a single unit. Pick one of the harder jobs to lubricate—one where oil replacements are made most frequently. See if you don't get the same results as many other plants, where Stanoil has cut oil replacements one-half to one-third and even more on the tougher jobs. It has eliminated cleaning entirely on some systems. For instance—

## HERE'S A TYPICAL APPLICATION

A new compressor in a Michigan machine tool plant had operated only two weeks when the conventional oil in use oxidized and turned black. The machine was operated almost continuously. Time out for cleaning the oil system could not be spared. Neither could the labor required for making the oil changes. A fill of Stanoil was put into the compressor. Now, oil is changed every three months instead of every two weeks. No cleaning is needed. As a result of this test all hydraulic and circulating systems in this plant are using Stanoil.

## A LUBRICATION ENGINEER WILL HELP YOU

You pick the job for a test. A Standard Lubrication Engineer will recommend the grade of Stanoil needed. It won't be long before you'll notice how Stanoil keeps its color and reduces deposits. Just write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago, Illinois, for a Lubrication Engineer to help you make the test.

**OIL IS AMMUNITION . . . USE IT WISELY**

# STANDARD OIL COMPANY (INDIANA)

LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION ENG

LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBRICATION

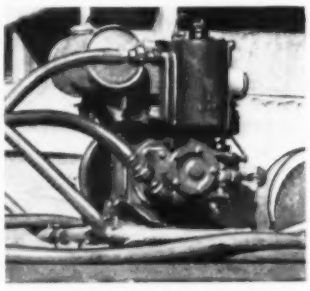
## TO HELP YOU SOLVE UNUSUAL LUBRICATING PROBLEMS

FREQUENTLY, features of design in a machine raise difficult problems in lubrication. There is a simple way to solve them. Here are two examples:

**EQUIPMENT** A manufacturer developed a labor-saving electric concrete tamper using a three-phase induction motor with an off-balance weight on the rotor shaft to provide a vibrating motion. The motor operates at 3600 to 5000 r.p.m. The undamped amplitude of the vibrator unit is about one-fourth of an inch.

**PROBLEM** The motor rotor is supported by ball bearings. The lower bearing takes about 85% of the load. It was difficult to keep grease in this bearing and it had a very short life if not properly lubricated.

**RESULT** A number of brands of grease were tested. Some of them lasted but a few days. Superla 4X was recommended by a Standard Oil Engineer. It did the job. From the moment it was used, the bearings needed greasing only every two to four weeks. Superla gave good lubrication, without separating or caking. (Superla Grease No. 3X is better in cooler climates.)

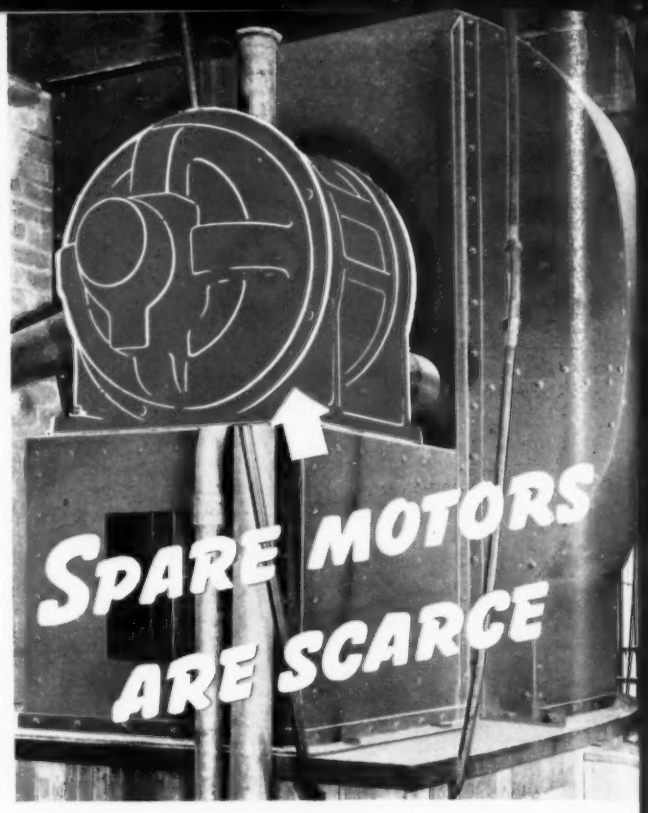


**EQUIPMENT** This same company makes a "Hydro-Spade" containing a hydraulically operated internal-type concrete vibrator. This consists of a vane-type hydraulic motor operating at 7,000 r.p.m., and a gear pump supplying 27 gallons of oil per minute to a motor at 160 lbs. per square inch pressure.

**PROBLEM** The motor must maintain a constant speed. As this unit is operated in all climates, the hydraulic oil used must not thicken at low temperatures and slow down the motor or thin out excessively at high temperatures.

**RESULT** Indoil No. 7 was one of the many oils tested. The viscosity characteristics and low pour point of Indoil met all requirements. The manufacturer has made Indoil available to all his customers to make sure they get the most efficient operation of the equipment.

When you have problems like these, solve them by getting the recommendation of a Standard Lubrication Engineer. Test the products he suggests. You'll save time and perhaps avoid the expense of developing special lubricants by getting the results you want from one of the wide range of standardized lubricants Standard Oil offers.




## KEEP MOTORS ON THE JOB WITH STANODRIP

Do you have certain motors in your plant that are always in trouble—bearings that overheat—windings that become oil soaked—motors that require constant watching and frequent cleaning?

When spare motors and time were plentiful you could take these trouble-makers off the job and try to correct their faults. But there's neither time nor motors to spare today. Yet that doesn't mean that you have to nurse these troubles along for the duration.

Here's what you do. Where you have a motor that seems to be using a lot of oil, or where oil is creeping along the shaft and getting into the windings, test Stanodrip on it. It's designed for just such hard-to-lubricate jobs. Here's an example:

The motor on the blower pictured above was being oiled twice a week, it required frequent cleaning, and was overheated continuously. After a thorough cleaning Stanodrip No. 39 was put in the bearings. Now, oil cups are filled once every three or four weeks. Dirty windings are practically eliminated, reducing maintenance cost by about 50% on this motor. Best of all, the operator has quit worrying about failures from overheating.

Have a Standard Lubrication Engineer choose the grade of Stanodrip you need for the job you pick.

## HERE'S WHERE YOU'LL FIND A STANDARD OIL ENGINEER

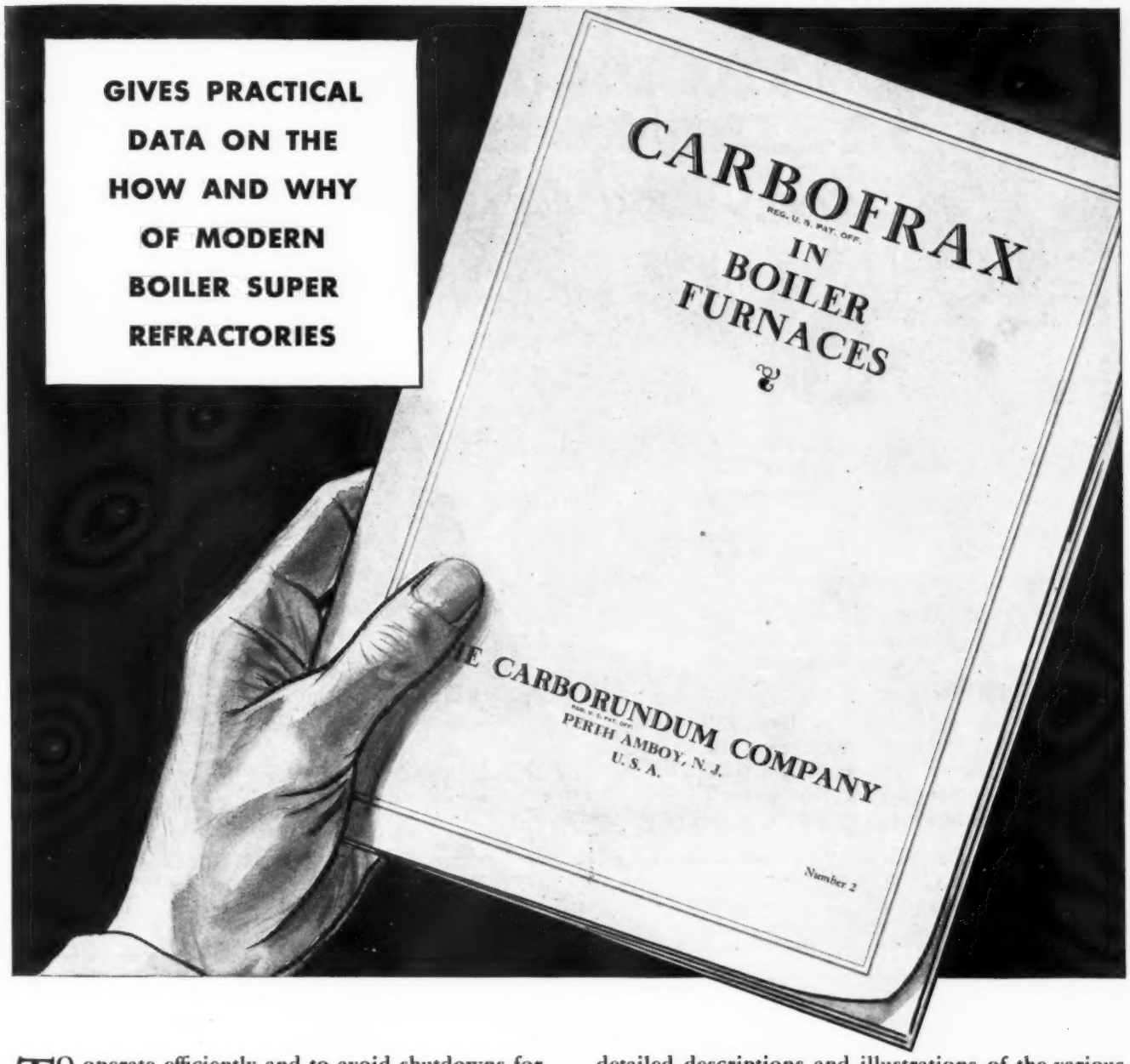
Call any local Standard Oil Company (Indiana) office in the middle western states listed below, or write 910 South Michigan Avenue, Chicago, Illinois. In Nebraska, write Standard Oil Company of Nebraska at Omaha.

COLORADO • ILLINOIS • INDIANA • IOWA • KANSAS • MICHIGAN
MINNESOTA • MISSOURI • MONTANA • NORTH DAKOTA
SOUTH DAKOTA • WISCONSIN • WYOMING

OIL IS AMMUNITION...USE IT WISELY

STANDARD OIL COMPANY (INDIAN

# FREE BOOKLET




TO operate efficiently and to avoid shutdowns for furnace repairs in days like these requires a thorough knowledge of all factors affecting the construction and performance of the lining in boiler furnaces.

This free booklet tells how, when and where to use "Carbofrax" the Carborundum Brand Silicon Carbide Super Refractory. Whether or not you already use "Carbofrax" in your boilers, you will want to see its detailed descriptions and illustrations of the various types of boiler settings including air and water-cooled walls.

You'll find this booklet a valuable guide in selecting super refractories for your boiler furnace linings. It will help you to line your furnace more effectively and thus lower your costs through less frequent shutdowns.

Write for your free copy today.

REFRACTORY CARBORUNDUM PRODUCTS

*Refractory Division,* **THE CARBORUNDUM COMPANY,** *Perth Amboy, N. J.*

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District Sales Branches: Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh. Distributors: McConnell Sales and Engineering Corporation, Birmingham, Ala.; Christy Firebrick Company, St. Louis, Mo.; Harrison & Company, Salt Lake City, Utah; Pacific Abrasive Supply Company, Los Angeles, San Francisco, Calif.; Denver Fire Clay Company, El Paso, Texas; Smith-Sharpe Company, Minneapolis, Minn.

(Carborundum and Carbofrax are registered trade-marks of and indicate manufacture by The Carborundum Company)

# These BULLETINS... tell you How to select THE RIGHT THERMOMETER for your Process

Selection of the correct Thermometer for your specific application is as vital as your choice of process equipment, if maximum production is to be obtained.

Wheelco has published five new Bulletins, which illustrate and describe various types of Thermometers and explain their function in relation to their intended applications.

You will find a wealth of information in these Bulletins on Indicating Thermometers, Indicating Therm-otrols (Indicating, "Electronic Principle" Thermometer Controllers), Recording Thermometers and Recording Therm-otrols (Recording, "Electronic Principle" Thermometer Controllers), all of which are available in ranges from —100°F. to +1000°F., of —70°C. to +550°C. Also illustrated and described are Thermometer Bulbs, Bulb Sockets, Capillary, Capillary Armor, Charts, Chart Ranges, Scale Ranges, etc. Explanation of how the Flame-otrol (combustion safeguard), Purging Timers, Program Control and Proportioning Control can be integrally incorporated in the various Thermometers is given.

***Write for any one, or all, of these Bulletins without obligation.***

**Wheelco Instruments Co.**
863 W. HARRISON STREET • • • CHICAGO, ILLINOIS

*Originator of "Electronic Principle" Temperature Controls*


**Arkansas**—U. S. Eng, 300 Bway, Little Rock, awarded contract constructing imprvs, Lonoke Co, to D F Jones Constr Co Inc, Southern Natl Bldg, Little Rock, $500,000-$1,000,000.

**California**—Defense Plant Corp, 811 Vermont Ave N W, Wash., D. C. awarded contract constructing plant to H K Ferguson Co, 1650 Hanna Bldg, Cleveland, O. Est over $1,500,000. Industrial company will operate.

**California**—Industrial company awarded contract constructing 2 boiler erection bldg, Contra Costa Co, to H H Larsen Co, 64 South Park St, San Francisco. Federally financed.

**California**—Henry J Kaiser Co, 1522 Latham Sq Bldg, Oakland, will construct plant bldg, expansion, San Bernardino Co, own forces. Est $27,000,000. Federally financed.

**Florida**—U. S. Eng, U. S. Courthouse & Post Office, Jacksonville, awarded contract constructing imprvs, Duval Co, to Ebersbach Constr Co, Stovall Office Bldg, Tampa. $1,000,000-$5,000,000.

**Florida**—Yards & Docks, Navy Dept, 18 St and Constitution Ave, N W, Wash., D. C., awarded contract constructing imprvs, NOY 5460, to Ive H Smith Co, 1525 San Marco Blvd, South Jacksonville, S S Jacobs Co, Hildebrandt Bldg, Langston Constr Co, and Hubbard Constr Co, all of Jacksonville, $3,235,000.

**Georgia**—U. S. Eng, U. S. Courthouse & Customhouse, Mobile, Ala., awarded contract constructing summer air-conditioning sys, and ceiling insulation, Decatur Co, to Engineering Contractors, Inc, Bona Allen Bldg, Atlanta, under $50,000.

**Illinois**—Defense Plant Corp, 811 Vermont Ave, N W, Wash., D. C., awarded contract for design and construction addnl plant facilities, to Sumner S Sollitt & Co, 307 N Michigan Ave, Chicago. Est $1,200,000. Industrial Company will operate.

**Illinois**—U. S. Eng, 520 Merchandise Mart, Chicago, awarded contract construction for manufacturing plant, Cook Co, to Standard-McQueen-White, Forest Park, over $2,000,000.

**Ill., Lockport**—Texas Co, 332 S Michigan Ave, Chicago, awarded general contract, constructing plant addns, to Foster-Wheeler Corp, 105 W Adams St, Chicago. Est $2,000,000.

**Indiana**—Industrial company awarded contract constructing plant bldgs, power plant, etc to Jno Griffiths & Sons Constr Co, 220 N La Salle St, Chicago, Ill. Est $20,000,000. Defense Plant Corp will finance. Shaw, Naess & Murphy, 80 E Jackson St, Chicago, Ill., archts.

**Ia., Boone**—Iowa Electric Light & Power Co, Boone, awarded contract for electrical work for power house, own forces.

**Kentucky**—U. S. Eng, Federal Bldg, Louisville, awarded contract constructing imprvs, Union Co L G Arnold, Inc, Buren Const Co, J R Griffith Co, and McCarthy Improvement Co. P O Box 192, Eau Claire, Wis., under $1,000,000.

**Louisiana**—Industrial company awarded contract constructing plant to Turner Const Co, 420 Lexington Ave, New York. Est $30,000,000. Federally financed.

**Massachusetts**—U. S. Eng, 819 Industrial Trust Bldg, Providence, R. I., awarded contract constructing imprvs, grading, drainage, etc. Hampden Co, to David Nassif Co, 20 Providence St, Boston, $500,000-$1,000,000.

**Michigan**—U. S. Eng, 700 Union Guardian Bldg, Detroit, awarded contract con-

# COMPACT VALVE CATALOG

## Veteran Edward Workers Keep Quality High

### "KNOW HOW" LEARNED BY EXPERIENCE

Increased war production has brought no lowering of exacting peace-time standards at the Edward plant, for the Edward personnel is well seasoned with veterans who have the valve building "know how" gained from years of experience.

PAUL NIEMETZ, a 22-year veteran, assembles a 600 lb Edward cast steel valve

Scarcely a department in the Edward plant is without men with 20 years or more experience building Edward steel valves. To the buyer, this is important. It means that the Edward policy of accurate workmanship, rigid inspection and complete laboratory control will be maintained in such a way that today's Edward valves will be just as dependable and long lived as always.

TYPICAL REPRESSURING hook-up in Texas oil fields uses Edward Fig. 158 valves. These forged steel valves, for hydraulic and gas pressures to 6000 lb, are used in many services.

## NO GUESSING—

Edward engineer checking the diameter of a plug gage on 48 in. Pratt & Whitney measuring machine which permits readings to 0.00001 in. Thread comparators, light wave measuring units, comparison blocks and other high precision equipment in the air conditioned Edward Bureau of Standards substitutes exact knowledge for guesswork in building Edward valves.

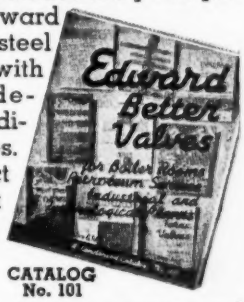
All working gages in the Edward plant are checked at regular intervals to insure constant accuracy.

## Edward No. 101 Streamlined to Save Your Time

### A POST CARD BRINGS YOU THIS HANDY BOOK

To simplify war-time purchasing, Edward is offering a streamlined, fact-packed and easy-to-use BETTER VALVES Catalog No. 101.

This catalog includes the principal valves of the Edward cast and forged steel line, complete with illustrations, descriptions and dimensional tables. Yet it is compact enough to fit easily into your desk drawer or brief case.




CATALOG No. 101

If you haven't a copy, a post card will bring you one promptly. Just ask for BETTER VALVES Catalog No. 101.

## EValloy Adds Life to Vital Parts of Edward Stop Valves

### DESIGNED FOR SURE, EASY OPERATION

Long life, sure shut-off and free flow are important features of Edward forged steel globe and angle stop valves.

Parts subject to greatest wear are made of EValloy, Edward's specially developed stainless steel which is exceptionally resistant to corrosion and erosion.

The forged and heat treated full area bodies are contoured for maximum freedom of flow, yet the basic design of Edward stop valves is such that positive, drop-tight closure is assured.

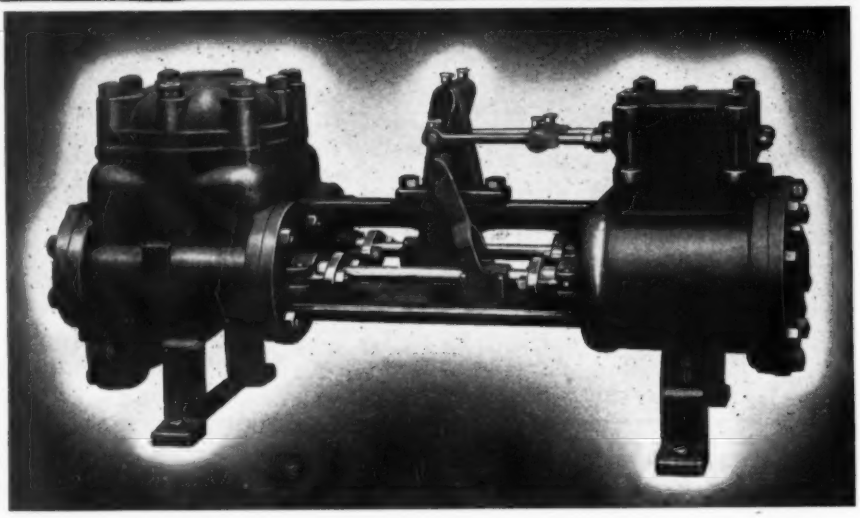
EDWARD FIG. 2688, forged steel, O.S.& Y. globe stop valve for 600 lb service. Same valve of inside screw construction is Fig. 2698. Both are built in 1/4 in. to 2 in. sizes, and in angle design as well.

**THE EDWARD VALVE & MFG. CO., INC.**
1220 WEST 144th STREET . . . EAST CHICAGO, INDIANA

# EDWARD *Steel* VALVES
CAST AND FORGED

# WARREN'S

## "No Compromise" Policy means Dependability and Long Life



Because Warren never compromises with sound engineering principles, cheapens at the expense of reliability, barters safety for price advantage or recommends along the border line—Warren Pumps give long and efficient service at lowest possible operating and maintenance costs.

These brief Warren Case Histories are typical—

**June 15, 1901. . . .** A Warren Horizontal Duplex still doing duty with a Coast Guard Unit.

**November 28, 1899 . . . .** A Warren Horizontal Duplex Pump originally sold a municipality but of late years in service at a rendering company.

**October 2, 1899 . . . .** A Warren Duplex Pump still on duty at a Connecticut brass works.

**1901 and 1911 . . . .** Two Warren Hydraulic Pumps still on the job at a Pennsylvania cork products manufacturer.

**1924 . . . .** Two Warren steam-driven vacuum pumps on duty for past eighteen years, 24 hours a day, 365 days a year.

Warren also manufactures a complete line of centrifugal pumps. *Whatever* type of Warren Pump you select you can be sure of getting dependability and long life.

## WARREN STEAM PUMP CO.

INCORPORATED

Warren, Massachusetts


structing power, control and lighting sys, Chippeawa Co, to Harlan Electric Co, 3139 Hamilton St, Detroit, less than $1,000,000.

**Michigan**—U. S. Eng, 700 Union Guardian Bldg, Detroit, awarded contract constructing imprvs, Washtenaw Co, to Paul M Sterling Co, 114 Liberty St, New York, N. Y., less than $1,000,000.

**Michigan**—U. S. Eng, 700 Union Guardian Bldg, Detroit, awarded contract constructing bldgs, Chippewa Co, to J E Kennedy, Sault Ste. Marie, less than $1,000,000.

**N. J., Little Falls**—Beattie Mfg Co, Main St, awarded contract constructing power plant to L H Focht & Son, 529 Court St, Reading, $60,000. Gilbert Assoc Inc, 412 Washington St, Reading, Pa., engrs.

**N. J., Lyndhurst**—Leslie Co, Grant Ave, awarded contract constructing boiler plant to Child & Scott-Donohue, Inc, 153 E 38 St, New York, N. Y., $10,000.

**New Mexico**—U. S. Eng, Albuquerque, awarded contract constructing imprvs, Lea Co, imprvs, Lea Co to Harco Constr Co, G Kies and Waco Constr Co, Waco, Tex., less than $1,000,000 • • addnl bldgs to E S McKittrick Co, Inc, Carlsbad, less than $200,000; addnl bldgs, to Jim Handley Inc, San Antonio, Tex., less than $200,000.

**New Mexico**—U. S. Eng, Albuquerque, awarded contract air conditioning and dust-proofing bldgs, various locations, to Matthews Engineering Co, 2122 Olive St, Dallas, Tex., under $50,000.

**New York** — U. S. Eng, Romulus, awarded contract constructing bldgs, utilities, Seneca Co, to W E Bouley & Co, Auburn. $500,000-$1,000,000.

**North Carolina**—U. S. Eng, 33 Customhouse, Charleston, S. C., awarded contract constructing cold storage bldg, Union Co to W H Hand & Son, Belmont, $50,000-$100,000.

**Ohio, Fairfield**—Federal Works Agency, 222 W No Bank St, Chicago, Ill., awarded contract constructing pump plant, reservoir, mains and equip, to W F Schmidt, 1049 Philadelphia Dr, Dayton. $27,429.

**South Carolina**—U. S. Eng, Florence, awarded contract constructing bldgs, miscellaneous structures, Florence Co, to B & F J Constr Co, Conover, N. C., $500,000-$1,000,000.

**Tennessee**—U. S. Eng, P. O. Box 97, Memphis, awarded contract constructing steam generating plant, bldg and steam distr sys, also lubrication sys, all Lauderdale Co to W A Beck, Inc, 1031 S Big Ben Blvd, St. Louis, Mo., under $150,000.

**Texas**—U. S. Eng, Albuquerque, N. M., awarded contract air-conditioning, dust-proofing various bldgs, various locations, to Matthews Engineering Co, 2122 Olive St, Dallas, under $50,000.

**Texas**—U. S. Eng, 231 W Main St, Denison, awarded contract for air-conditioning facilities and electrical work, Tarrant Co, to Dallas Air-Conditioning Co, Construction Bldg, Dallas, under $50,000.

**Texas**—U. S. Eng, Federal Bldg, Galveston, awarded contract constructing cold storage sys, Howard Co to Van Cleve Constr Co, 3608 Telephone Rd, Houston, $100,000-$500,000.

**Texas**—U. S. Eng, Albuquerque, N. M., awarded contract constructing imprvs, Reeves Co, to E Loyd, Fort Worth. $500,000-$1,000,000.

**Texas**—U. S. Eng, Fort Sam Houston, awarded contract constructing laundry and boiler house, Spec 42-485, Kinney Co,

# Beware of the "Gremlins" that Ruin V-Belt Drives

GREMLINS, those imaginary pixies which infest R. A. F. planes and cause no end of trouble, were invented by the fliers to alibi mistakes, neglect and bad marksmanship.

There are also Gremlins in every plant using Multiple V-Belt Drives. Properly named, they are Ignorance, Neglect and Carelessness. And, they cause incalculable damage to V-Belts at a time when rubber is figuratively worth its weight in gold.

To help power users drive out these destructive forces, the Engineering Research Bureau of the Multiple V-Belt Drive Association has prepared a primer on the selection, installation and maintenance of Multiple V-Belt Drives. This book, "23 Ways to Conserve the Life of Your Multiple V-Belt Drives," is the Association's contribution to the rubber conservation effort and is available without cost to all who request it.

**TRADE MARK**

*The use of this emblem by an association member in connection with Multiple V-Belt Drives is your assurance of mechanical excellence . . . the result of cooperative engineering, research and experience.*

**MULTIPLE V-BELT DRIVE ASSOCIATION**

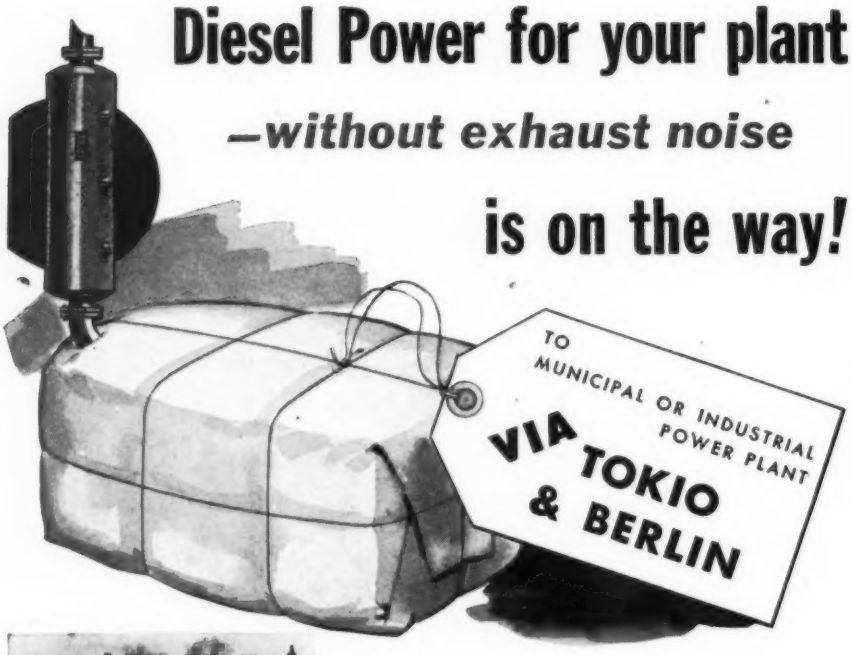
140 SOUTH DEARBORN ST., CHICAGO

*Write for this FREE Association Book Today!*

# Diesel Power for your plant

## —without exhaust noise

## is on the way!



*New municipal plant at Brooklyn, Iowa, with Snubber-equipped engines.*

*Four Snubbers at Shell Oil Company's East Cromwell, Okla., plant*

**If that Diesel engine you want is hard to get, be patient. There are a couple of dictators holding up shipment.**

**When you do get it, be sure it's equipped with a Burgess Exhaust Snubber. Your neighbors will sleep better, and you'll appreciate having a quiet exhaust without any sacrifice of engine efficiency.**

**You can't beat a Burgess Snubber for efficient elimination of exhaust noise. Operating on the Burgess snubbing principle, it *prevents*—not muffles—the noise. So don't ask for a "muffler"—specify a Snubber. Hundreds of installations in hotels, hospitals, office buildings, municipal plants, and other critical locations are proof of its success. Burgess Battery Company, Acoustic Division, 2823-L W. Roscoe St., Chicago.**

*Originators of Snubbing Principle for Quieting Diesel Exhausts*

**BURGESS**
**DIESEL EXHAUST**
**SNUBBERS**

**Cuts your gasket costs in half**

**The most remarkable tool ever invented**

***Write for booklet***

**THE ALLPAX GASKET CUTTER**

***Manufactured by***

**THE ALLPAX COMPANY, INC.**

***Distributors everywhere*** ***Mamaroneck, N. Y.***


to Investment Service Corp, Kirby Bldg, Dallas, over $200,000.

**Washington**—U. S. Eng, 800 3 Ave, Seattle, awarded contract constructing water supply line, also steam supply and distr sys, to Spencer B Lane Co, 251 Kearney St, San Francisco, Calif, both $100,000-$500,000; incinerator, to Hansen & Weldner, 1517 W Jackson St, Spokane, under $50,000, all foregoing in Spokane Co.

**Outside United States**—Yards & Docks, Navy Dept, 18 St and Constitution Ave, N W, Wash., D. C., awarded contract constructing fuel pipeline installation, NOY 5753, to Williams Bros Corp, 324 Natl Bank of Tulsa Bldg, Tulsa, Okla., $4,250,000.

# New Equipment

*(Continued from page 140)*

able high gloss white enamel finish that assures reflectance and lighting efficiency comparable in quality to porcelain enamel, manufacturers state. Other features are (1) Tulamp high power factor ballast exposed through top of fixture to permit cooler operation and longer life, and (2) starter switches mounted on top of unit so that they may be removed without disturbing lamps. *Mitchell Mfg Co, 2525 Clybourn Ave, Chicago, Ill.*

## Resistance Starter

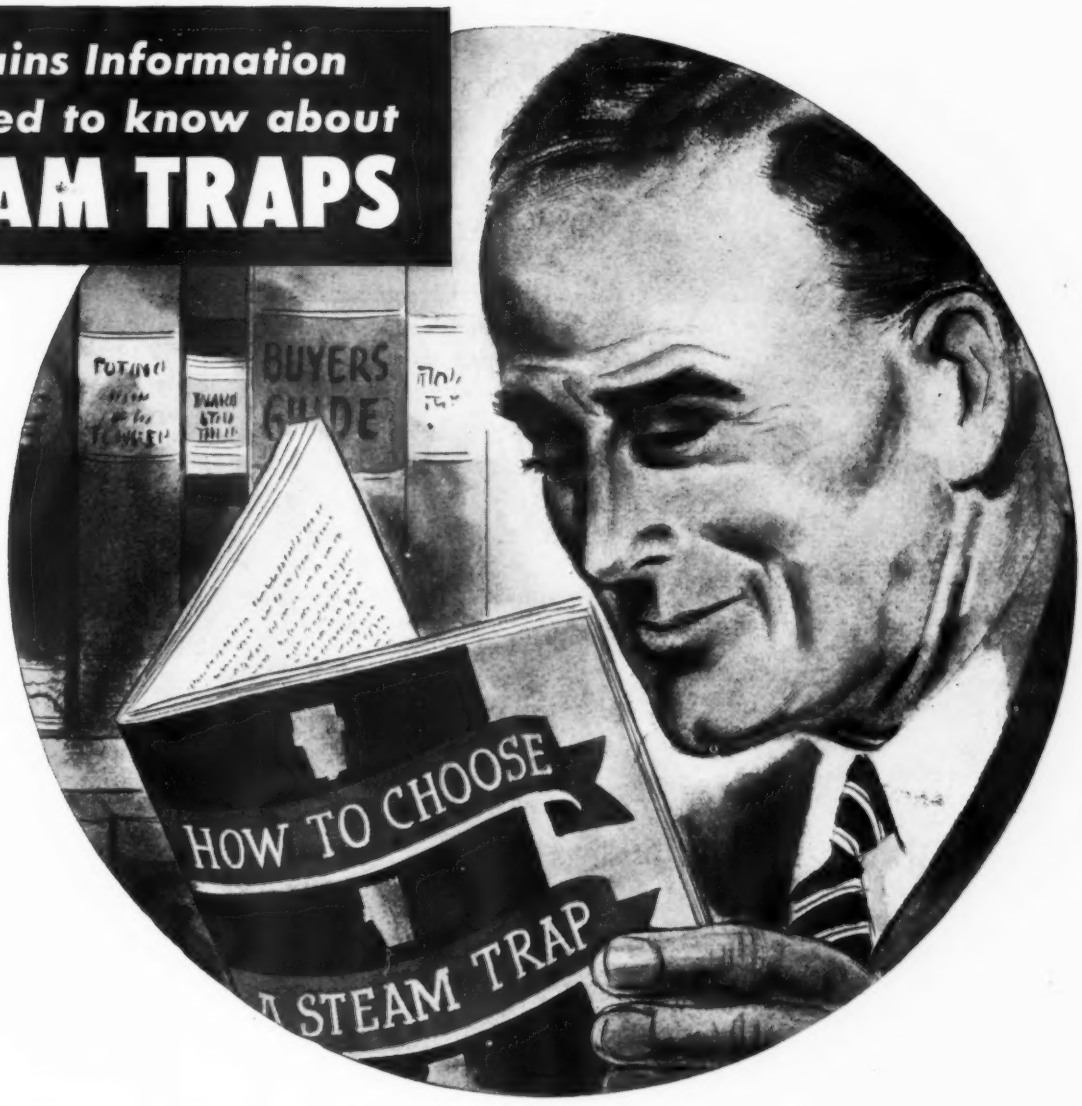
COMPLETE LINE of Bulletin 640 semiautomatic resistance starters now offered by company for manually starting polyphase squirrel-cage motors. These starters recommended for loads which must be accelerated smoothly, or for applications where starting currents must be kept low to prevent lamp flicker. Stepless current control provided by action of the Bradley-unit graphite compression resistors. Current is never interrupted at any time during starting cycle, and smooth control is obtained. Rate of acceleration can be limited by previous adjustments so that the motor cannot be started too rapidly. *Allen-Bradley Co, 1311 S First St, Milwaukee, Wis.*

## Detector for Transformers

HCL DETECTOR FOR Inerteen transformers, a new method of protection which minimizes damage to transformer windings by its quick detection of very small arc, is announced by company. Detector may be used to give prompt warning of even very small arc by detecting the presence of HCL gas formed by the decomposition of the liquid. Because the detector operates almost as

## *Contains Information you need to know about*

# STEAM TRAPS

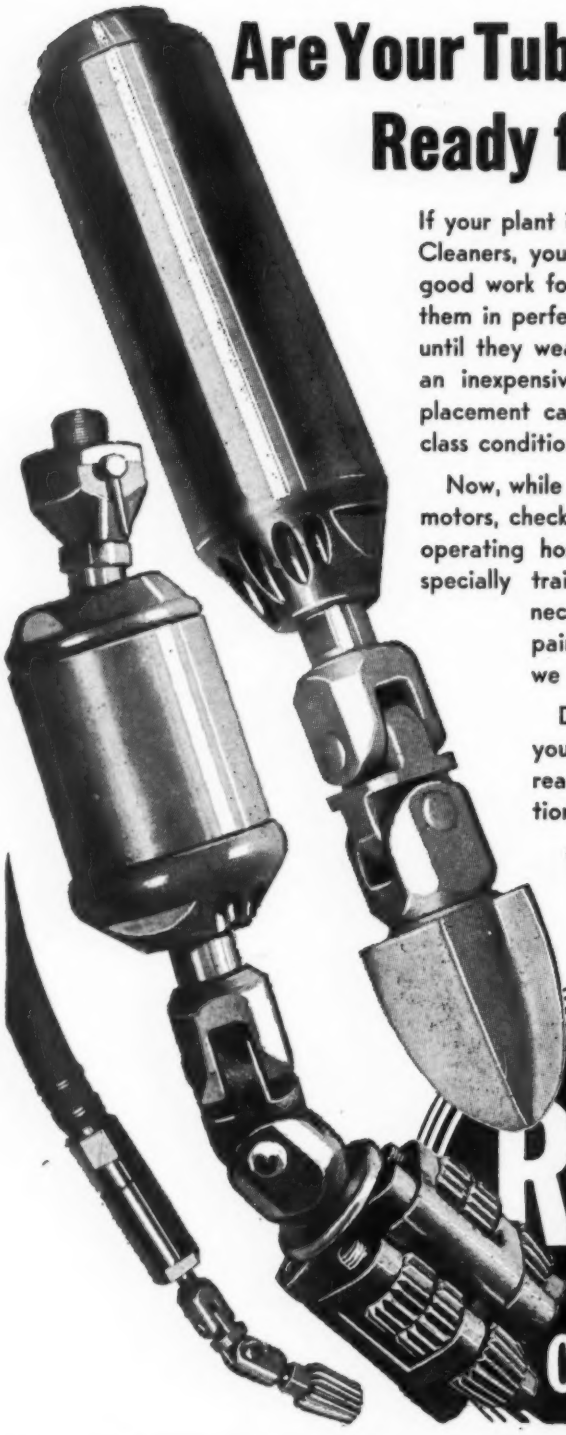



THE BOOK "How To Choose A Steam Trap" contains information you need to know about steam traps. It's an invaluable reference book for power engineers and owners of steam using equipment. For example: Suppose you want to know how to simplify piping, how to save steam trap installation time, or how to cut down on the number of necessary fittings. You can find the answers in this book. If you want to know the best way to trap a unit heater, pipe coils, fan systems, kitchen equipment, autoclaves, laundry equipment, or submerged surfaces—this book tells you. And in addition you'll find tables giving trap ratings, sizes of traps and various capacities for different uses. Forty pages of condensed, easy-to-understand information and it's yours for the asking. Just send us a request

on your own letterhead for the book "How To Choose A Steam Trap."

**THE V. D. ANDERSON COMPANY**
**1934 West 96th Street • Cleveland, Ohio**

# Are Your Tube Cleaners Ready for Action?



If your plant is equipped with Roto Tube Cleaners, you can help to continue their good work for a longer time by keeping them in perfect running order. Why wait until they wear out beyond repair, when an inexpensive adjustment or parts replacement can bring them back to first class condition, if done in time?

Now, while you think of it, examine your motors, check your stock of cutter heads, operating hose and couplings. Let our specially trained mechanics make any necessary adjustments or repairs. By giving us a little time we can serve you much better.

Don't put it off. See that your Roto Tube Cleaners are ready for the Battle of Production, now.

**The ROTO Company**
145 Sussex Avenue
NEWARK, N. J.

**ROTO TUBE CLEANERS**



**They WEAR themselves into perfect condition**

**SEA-RO GRAPHITIZED**
**PUMP PLUNGER RINGS No. 528**

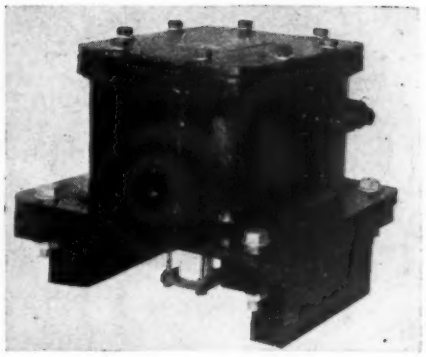
Tests prove that Sea-Ro Graphitized Rings acquire a hard glass-like surface after long operation, and being of a floating type, reduce wear on cylinder liners.

Sea-Ro No. 528 Rings are recommended for plungers of pumps handling hot or cold water, oils, gasoline, solvents, ammonia, etc.

For large heavy-duty, use Sea-Ro No. 525 Rings, with patented internal expansion spring.

*Send for detailed information*

SEA-RO PACKING CO., INC., WOOD-RIDGE, N. J.

soon as the arc occurs, it reduces the possibility of high pressures forming within the tank. The detector can be used to operate an alarm, or to operate the circuit breaker, thus disconnecting the transformer from the feeder. It is easily installed on new or existing transformers. *Westinghouse Electric & Mfg Corp, East Pittsburgh, Pa.*

## Small Wire Terminal

SMALL WIRE TERMINAL, Burndy Hylug, features exceptional compactness and lightness of weight. Many variations available—with a sighthole for inspection; with a closed back for moisture-proof sealing; with or without an insulation shroud; in many different tongue shapes and dimensions. Installation is simply and rapidly accomplished by

means of the Hytool, specially designed pliers, or by pneumatic Hypresses. Either tool indents the lug on the cable to the proper depth resulting in a secure, highly efficient connection. Illustration shows (right) Hylug with marked Versiflex insulating sleeve, and (left) Hylug uninsulated. *Burndy Engineering Co, 107 Eastern Blvd, New York, N. Y.*

## Fluorescent Fixture

MANUFACTURER ANNOUNCES eight new industrial fluorescent fixtures with composition reflectors. Fixtures range in size from 100 to 300 watts, and are available for either individual or continuous-row mounting. Reflectors are finished in Mira-coat baked white enamel, and the outside in French gray. Come complete with superior Sylvania fluorescent lamps and Mirastat starters—all ready to install and operate. Sylvania's new adaptable slide-grip

# Slit It Open and SEE the Difference

Two important factors govern the selection of wire and cable for "hot-spot" service in steel mills, power plants and various vital industries. First, the conditions under which the circuits must operate, such as around soaking pits, boilers, furnaces, steam lines, drying ovens, rheostat grids; places where resistance to heat and moisture, corrosive fumes, oil, grease and even fire is essential. Second, and most important, is the construction of the wire—its in-built ability to stand up under these severe conditions.

Rockbestos A.V.C. Power, Motor Lead and Lighting Wires and Cables (Underwriters' and N.E. Code, Type AVA) meet the requirements of "hot-spot" service with permanent insulation that won't bake brittle, crack, bloom, swell or rot and has a maximum operating temperature rating of 110° C. (230° F.).

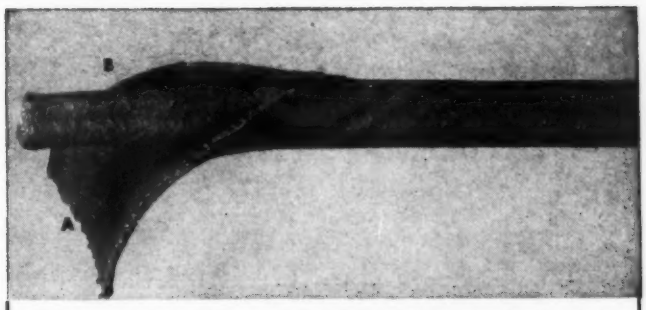
Apply the knife-test to a sample of Rockbestos A.V.C. and you'll find the answer to production losses and unnecessary maintenance due to wire-failure beneath the braid. Send for a sample and dissect it yourself. Rockbestos Products Corporation, 879 Nicoll St., New Haven, Conn.

## ROCKBESTOS A.V.C.

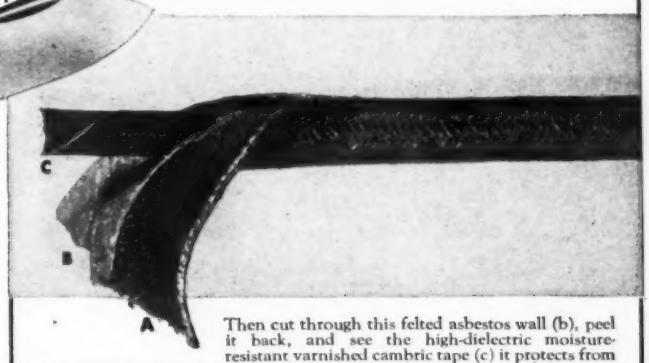
### *The Wire with Permanent Insulation*

*122 different permanently insulated wires, cables and cords*

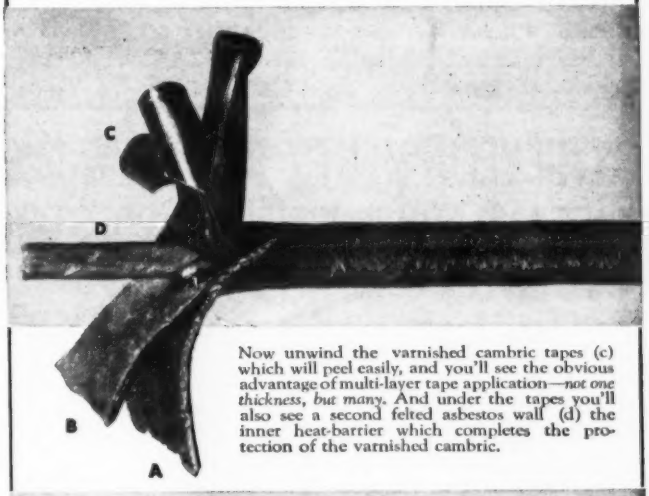
*developed by Rockbestos for various severe operating conditions*



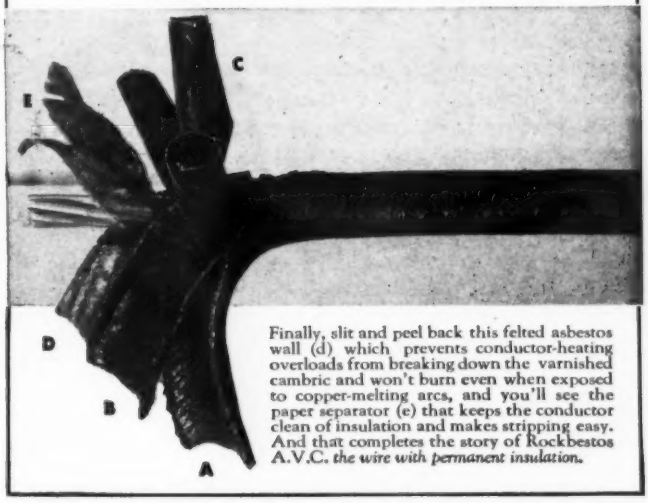

Take a sample of Rockbestos A.V.C. Power Cable, illustrated, or similarly insulated Motor Lead Cable, slit open the slick-finished heavy, heatproof, fireproof asbestos braid (a) which is resistant to moisture, oil and grease, and you'll find beneath a firewall of felted asbestos (b) a permanent heat-barrier against high ambient temperatures.




Then cut through this felted asbestos wall (b), peel it back, and see the high-dielectric moisture-resistant varnished cambric tape (c) it protects from heat, flame and oxidation. Notice too, the uniform coverage of the tapes, helically applied like the felted asbestos to assure perfect and permanent centering of the conductor in the insulation.



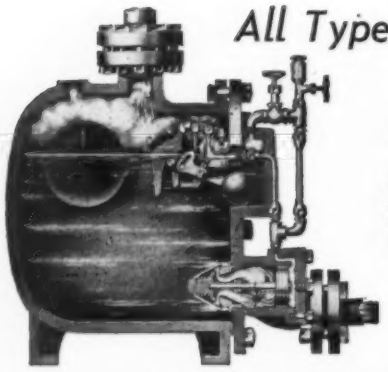

Now unwind the varnished cambric tapes (c) which will peel easily, and you'll see the obvious advantage of multi-layer tape application—*not one thickness, but many.* And under the tapes you'll also see a second felted asbestos wall (d) the inner heat-barrier which completes the protection of the varnished cambric.




Finally, slit and peel back this felted asbestos wall (d) which prevents conductor-heating overloads from breaking down the varnished cambric and won't burn even when exposed to copper-melting arcs, and you'll see the paper separator (e) that keeps the conductor clean of insulation and makes stripping easy. And that completes the story of Rockbestos A.V.C. *the wire with permanent insulation.*

NEW YORK, BUFFALO, CLEVELAND, CHICAGO, PITTSBURGH, ST. LOUIS, LOS ANGELES, SAN FRANCISCO, SEATTLE, PORTLAND, ORE.

## *All Types of* NICHOLSON TRAPS *Deliver Super-Service*

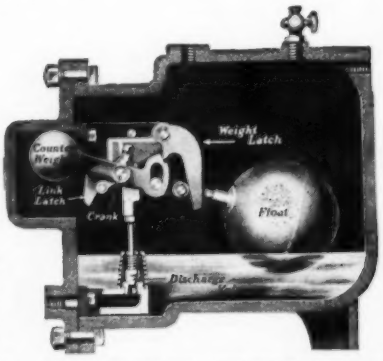


**PISTON OPERATED**

A compact trap with super capacity. Positive, instantaneous, non-wire-drawing discharge valve—entirely open or fully closed at all times. Stainless steel valves, seats and all working parts. For super-pressures and super-heat, specify Nicholson piston operated traps.

**WEIGHT OPERATED**

Positive automatic intermittent action. Large capacity. Pressures to 1500 lbs. at 1000 degree max. temp. Meets ALL requirements of modern high pressure power plants.



★

THERMOSTATIC models are non air-binding . . . freeze-proof . . . non dribbling . . . require no adjustments . . . never waterlog. Large capacity. Four types. Sizes ¼" to 2". Pressures from vacuum to 300 lbs.

CATALOG NO. 941—W. H. NICHOLSON & CO., 125 OREGON ST., WILKES-BARRE, PA

# NICHOLSON *Traps*

THERMOSTATIC ▼ PISTON AND WEIGHT-OPERATED STEAM GASOLINE AND COMPRESSED AIR TRAPS

CONTROL VALVES ▼ FLOATS ▼ MANDRELS ▼ STEAM AND AIR SEPARATORS



# NEW DEVELOPMENTS BY FREDERICK ADD NEW THRIFT AND CONVENIENCE TO INDUSTRIAL STOKERS

**From careful analysis of common stoker faults . . . the re-designed line of Frederick Stokers . . . engineered to correct them.**

FULLY ACTIVE GRATE SURFACE. More grate area with low combustion rate per square foot! . . . Frederick Stokers has specially designed tuyeres with air ports arranged and proportioned to improve air distribution and insure maximum efficiency in combustion.

TUYERES ARE LOCKED IN PLACE—can't be removed without removing the locking rod—can't be raked up inadvertently.

WIND BOX IS COMPLETELY ENCLOSED. Simplifies and makes a neater installation; eliminates danger of efficiency loss through leaking brickwork.

DOUBLE CLEAN-OUT—gives easy access to *both* sides of the undergrate area. Permits thorough cleaning, faster.

Illustration shows bin feed model stoker

50% OVERSIZE MOTORS—PROPORTIONED AIR SYSTEM—IMPROVED HEAVY DUTY TRANSMISSION—*ask about all these; just write—*

**The Frederick Iron & Steel Company • Frederick, Md.**

**COMPLETE LINE OF CENTRIFUGAL PUMPS FOR ALL PURPOSES**

**STEAM OPERATED ASH CONVEYING SYSTEMS - ASH STORAGE BINS**


hangers included with all continuous-row models. (See POWER, Mid-December, 1942, pg 89). *Sylvania Electric Products Co, Salem, Mass.*

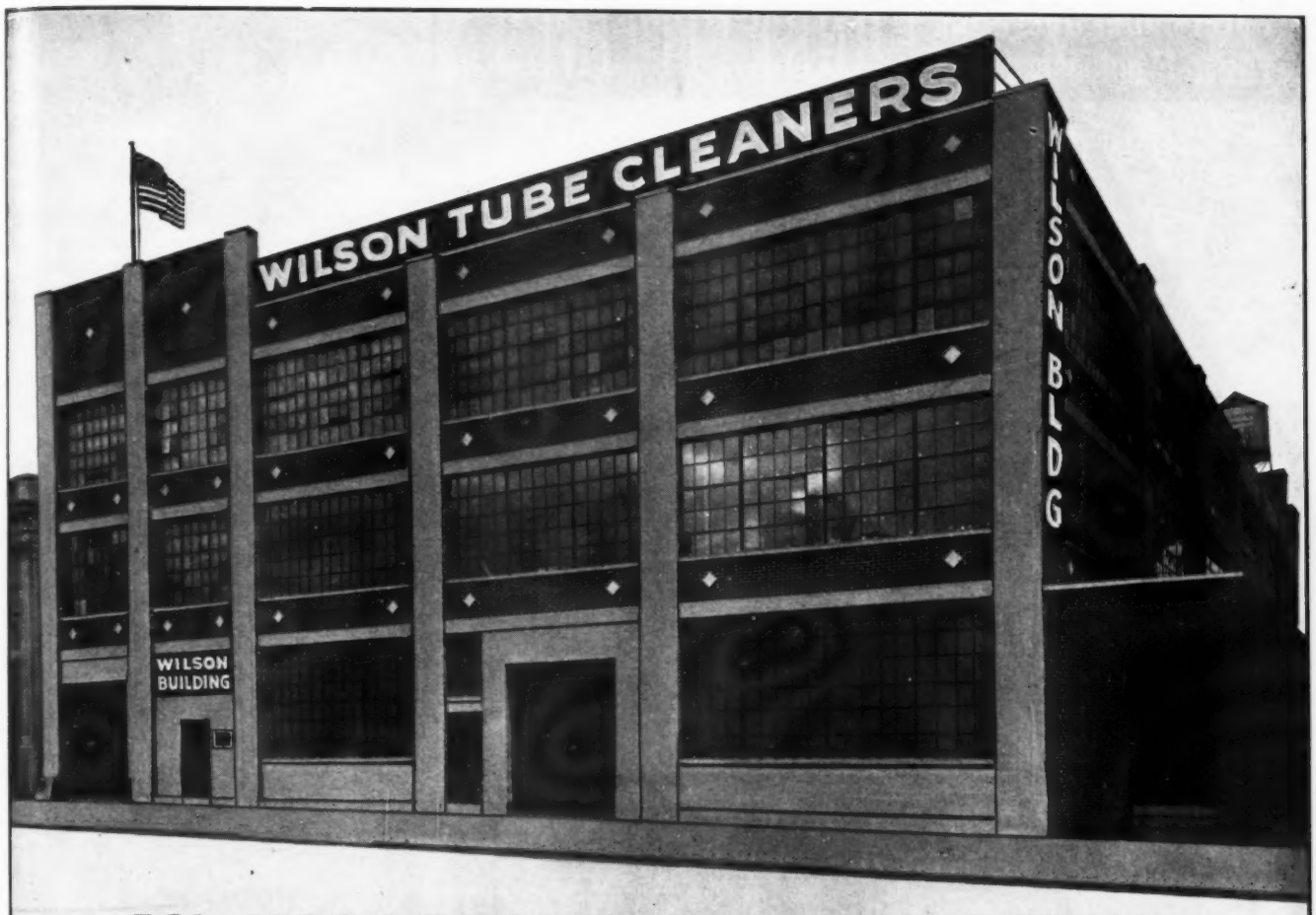
## Instrument Panel

COMPANY ANNOUNCES instrument and control panel made of Masonite reinforced with steel angles to conserve sheet steel vital to the war effort. Panel body is of cross-grained Masonite ⅝-in. thick bolted to a framework of 3 x 3 angle steel. Braces of 2 x 2 angle steel reinforce center of the panel to insure adequate support for instruments and controllers. Canopy and doors are also

cross-grained Masonite. In order to match finish standard for Hays steel panels, entire panel is first gone over with a sanding surfacer, after which the priming coat is sprayed on and rubbed down to a smooth base. This is followed by several coats of undercoater sanded and rubbed. After a thorough drying the finishing coats of black lacquer are sprayed on, giving a velvety finish. The inside is finished with two coats of gray lacquer. *The Hays Corp, Michigan City, Ind.*

## Steam-Jacketed Pumps

STEAM-JACKETED PUMPS are for handling liquids that must be processed or transferred while hot. New steam-jacketed heads are made of semi-steel, with threaded intake and exhaust steam ports, and drain plugs. Suitable for




# AN IMPORTANT ANNOUNCEMENT TO ALL TUBE CLEANER BUYERS

**Because it has become impossible for us to meet the ever increasing demand for Wilson Tube Cleaners and Wilson tube cleaning accessories in our plant at 47-28 37th Street, Long Island City, N. Y., we have purchased the building shown in the above photograph.**

**In our new home we will have available over three and one half times the floor space we had in our former plant. We have installed many new high speed machine tools and the greatly increased production capacity which these additional machines are giving us enable us to make more Wilson Tube Cleaners and accessories and also to make quicker shipments.**

**Write for the name of our representative nearest to you or ask for a copy of our NEW forty-page catalog which fully describes and illustrates the complete line of Wilson tube cleaning equipment.**

**INVEST IN AMERICA! BUY WAR BONDS AND STAMPS!**

## THOMAS C. WILSON, Inc.

*PIPE AND TUBE CLEANERS EXCLUSIVELY*

THE WILSON BUILDING

21-11 44TH AVE. LONG ISLAND CITY, N. Y.

Safer Boiler Operation
Easier Maintenance with ERNST FITTINGS

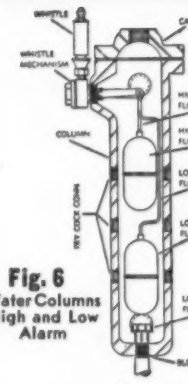


Fig. 6
Water Columns High and Low Alarm

Fig. 10
Plain Sight Illuminator

Fig. 9
Wire Glass Better-C Guards, All Sizes

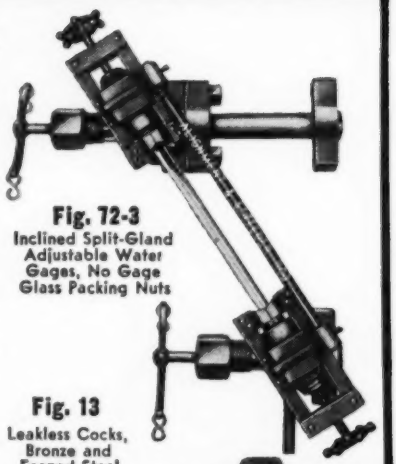


Fig. 72-3
Inclined Split-Gland Adjustable Water Gages, No Gage Glass Packing Nuts

Fig. 13
Leakless Cocks, Bronze and Forged Steel

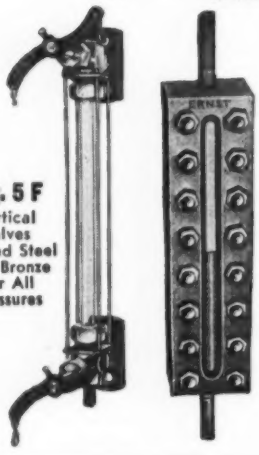
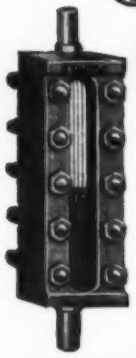


Fig. 5 F
Vertical Valves Forged Steel and Bronze for All Pressures

Fig 45
"C-Clear Thru" Flat Glass Inserts



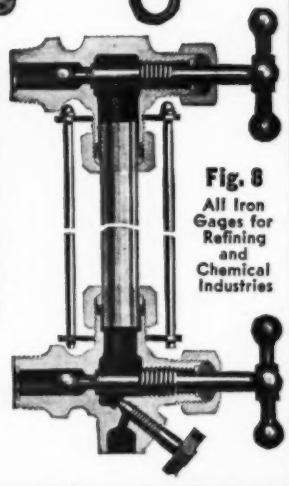


Fig. 8
All Iron Gages for Refining and Chemical Industries

Fig. 37
C-BLACK Prismatic Flat Glass Inserts

For Immediate Delivery, send us sketches or blue prints of your requirements, along with quantities needed. Highest quality material and workmanship to meet your specifications.

ERNST WATER COLUMN & GAGE CO.
LIVINGSTON, N. J. Phone: Livingston 6-0276

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5 SIZES FOR SMALL INDUSTRIAL USES
SCOTTIE JUNIOR BOILER
. . EACH ONE A REAL FUEL SAVER

*High Pressure Steam at Low Cost* . . . economical to buy and economical to operate. Compact yet easily accessible. Easy payments in accordance with U.S. Government regulations thru our Finance Corporation.

*For 6" rule with scale for reading pipe sizes, write Dept. 99K-1.*

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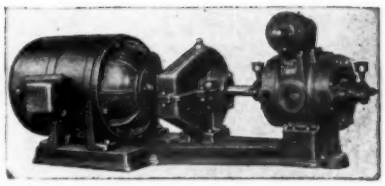
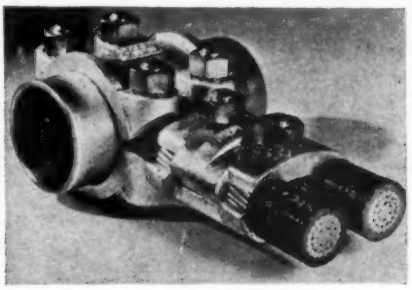
KEWANEE, ILLINOIS

steam pressures up to 125 lb. Standard Blackmer pumps in capacities from 20 to 700 gpm, and pressures up to 300 psi available with new steam-jacketed head. Furnished with either single or double reduction gear drive, and as single or multiple pump units. *Blackmer Pump Co, Grand Rapids, Mich.*

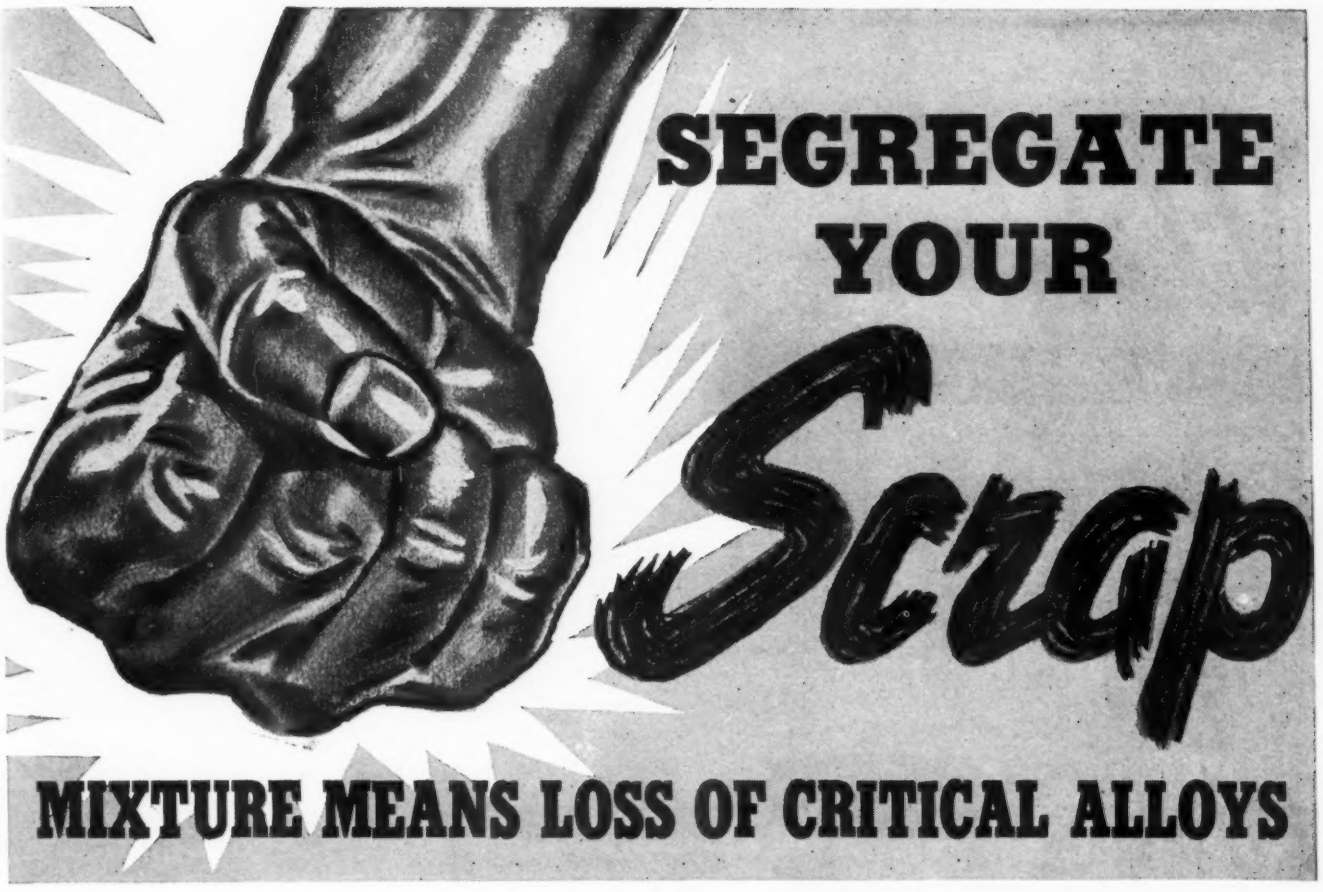
## Power Connector

KTC IS COMPACT, flexible fitting made with 2- or 3-wire branch taps, taking a wide range of wire sizes. With its use, according to the maker, there is a saving not only in installation time, but in elimination of the additional connector equipment ordinarily required with a one-tap style connector. The OZ interlocking clamp, incorporated for positive gripping of wires, binds all strands tightly in the lug. Hex-head bolts are held fast by recesses in the ruggedly constructed body of the connector. *O Z Electrical Mfg Co, Brooklyn, N. Y.*



## Cable Connectors

DALWELD WELDING cable connectors cannot be accidentally pulled apart; metal parts are machined from solid bar brass and insulated in a special composition casing. Quick-acting locking sleeve provides means to connect or disconnect the cable instantly by a quarter turn of connector. Expander type plug assures a wipe-joint fit plus large area contact and maximum conductivity on any size cable or amperage employed in electric arc welding. Connectors permit welding cable to be made up in standard length sections and hold ready for instant service the proper working length of cable for every job. This not only eliminates voltage loss by line drop, but also reduces operating cost and introduces savings in cable maintenance. *The Dallett Co, Philadelphia, Pa.*




SCRAP salvage is a vital factor in the war effort, and to be fully effective such a program must include methods for segregating and conserving critical alloying elements so urgently needed in the construction of war materials.

Ferrous and non-ferrous metal scrap should be collected in separate containers at the machine where they are generated. Each class of high-speed tool steel and each type of constructional alloy steel should likewise be kept separate so that the alloy content may be returned to service.

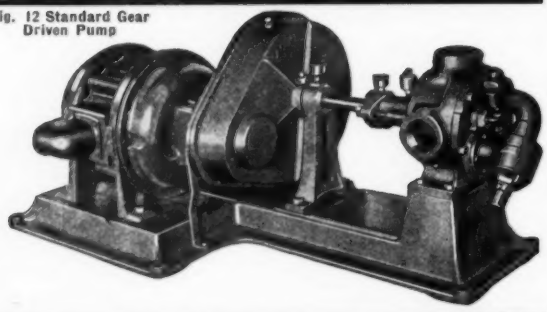
Remember,—alloy scrap which is segregated, classified and labeled according to type and composition is a vitally important commodity today—and urgently needed to augment primary supply of nickel, molybdenum, tungsten, etc.

***The metallurgical experience of our technical staff is available to aid you in these and other phases of conservation.***

**KEEP SCRAP MOVING INTO WAR PRODUCTION!**

**THE INTERNATIONAL NICKEL COMPANY, INC.** 67 WALL STREET NEW YORK, N. Y.

Fig. 12 Standard Gear Driven Pump



Viking

AN OLD-TIMER EVERY NEWCOMER SHOULD KNOW

**Lest You Forget**

When ordering pumps or parts it is necessary to give us your priority rating and allocation symbol. Be sure to obtain the highest rating, possible. Priority regulations are changed frequently. Check up and see if changes made improve your rating. Thank you.

VIKING PUMPS — FIRST IN AMERICA

Specify VIKINGS for your rotary pump equipment and make sure of dependable, trouble-free service. That's the goal of every man, new or old, in today's big battle of production. More than a million Viking Rotary Pumps are delivering topnotch production on the toughest kinds of jobs all over the world today. That is the best testimonial to Viking's simple design with only two moving parts; to Viking's sturdy, high-quality construction. For complete information write today for a free copy of Bulletin 802, which illustrates and describes Viking models, capacities, mounting styles and other specifications.

VIKING Pump COMPANY
CEDAR FALLS, IOWA

Are you troubled with Coal Segregation?

Stock CONICAL
COAL DISTRIBUTORS

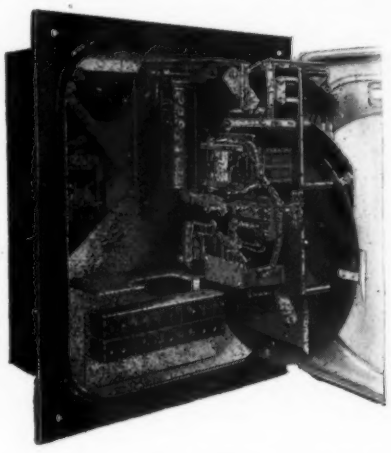
● By applying the principle of the cone to coal distribution, STOCK ENGINEERING CO. has developed this proved-through-use product for the distribution of coal without segregation on the boiler grates. There's no question of this distributor's value where unequal burning is a problem. As a cog in STOCK's "BUNKER-TO-STOKER and BUNKER-TO-PULVERIZER" boiler feeding installations, this distributor does excellent service in helping to extract maximum B.T.U.'s from the fuel. Investigate it today!

STOCK ENGINEERING COMPANY builds Coal Scales, Valves, Coal Stoppage Alarms, etc. . . . all products in their complete boiler feeding systems. Write for detailed drawings on all products.

STOCK ENGINEERING COMPANY
4807 THEODORE AVE. CLEVELAND, OHIO

## Flow Recorder

TWO-PEN electric flowmeter (actually two complete Cochrane flowmeters mounted within one double-depth case) meets requirements where panel space is at a premium, or where it is desirable to have two related flow records on the same chart for ready comparison. Both receiver mechanisms can be swung out and operate in the swung-



out position. The connection between the rear receiving mechanism and its pen arm must necessarily be detachable and is arranged with a self-aligning V-notch junction. Integrating feature can be furnished on both mechanisms, but reading of rear mechanism integrator requires opening case and swinging front mechanism forward. *Cochrane Corp, 17th & Allegheny Ave, Philadelphia, Pa.*

## Motor Selector

WITH "MOTOR FINDER" slide rule, motor user can match the conditions under which the motor must operate at the proposed installation with the required motor characteristics, and instantly learn the right motor type and its features. Three simple steps necessary to pick a motor. Slide rule can be used to select proper squirrel-cage motors only. Manufacturer points out that standard types of squirrel-cage are more versatile than is commonly realized. *Allis-Chalmers Mfg Co, Milwaukee, Wis.*

# *The Ideal* "TOP KICK"

Many an industrial commander, in these critical times, notes with keen satisfaction the smooth, well drilled performance of his steam power plant—and gives deserved credit to his "top sergeant": A Hays Combustion Control System.

Here, indeed is a seasoned, capable veteran, skilled at getting utmost efficiency out of the equipment he commands.

Automatically, "The All-Electric Way" Hays system controls combustion. It's made to do that. It regulates all combustion elements—measures each variation and corrects instantly—measures the correction: *maintains the right balance.*

With the nation's war effort putting extra demands on present steam power equipment, Hays Combustion Control Systems are doing an extraordinary job—stretching steam capacity, *safely;* getting the utmost out of existing boiler room equipment, *safely;* saving man-hours, saving operating costs.

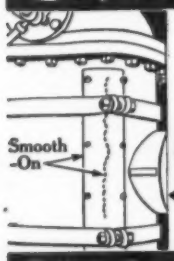
To enlist this veteran in your own service, send for the Hays Combustion Control Catalog—it is full of pertinent steam-power data.

THE MODERN SYSTEM *It's Electrical*

HAYS *Automatic* COMBUSTION CONTROL

THE HAYS CORPORATION • MICHIGAN CITY, IND.

# CRACKED! ...but SAVED with SMOOTH-ON




"Saved from the scrap heap by SMOOTH-ON" is the story that could be told by many an engineer about one or more important pieces of equipment in his plant. Condensers, pumps, heaters, evaporators, engines, compressors, valves and process apparatus . . . wherever a crack occurs in the shell or casing of these and similar types of machines, a SMOOTH-ON repair is speedy, simple, effective, and lasting.

*SMOOTH-ON applications require no heat, special tools, or dismantling of apparatus, and the expansive property of SMOOTH-ON wedges it tightly against the confining surfaces of the crack, making a lastingly tight seal.*

Today, when replacement of apparatus is difficult or impossible, and when lengthy repairs mean loss of valuable production time, SMOOTH-ON is more a plant necessity than ever before.

Get Smooth-On in 7-oz., 1-lb., 5-lb., 25-lb., and 100-lb. containers from your supply house, or if necessary from us. *For your protection, insist on Smooth-On, used by engineers and repair men since 1895.*

**40-Page Repair Handbook . . . . FREE**

40 Pages, 170 Diagrams, simple practical instructions for ingenious repairs to plant equipment, pipe lines, structures. Based on experiences of engineers all over the country. To obtain your FREE copy, just fill in and mail the coupon.

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Please send SMOOTH-ON HANDBOOK.

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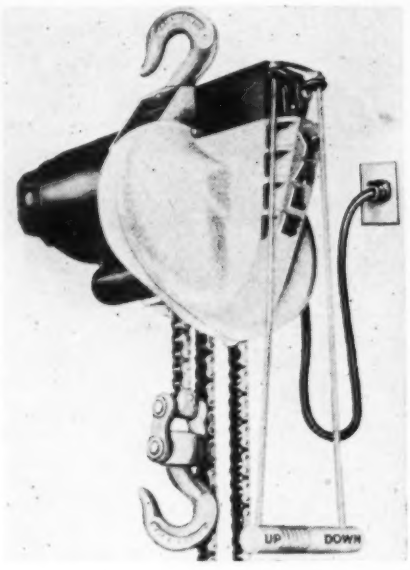
1-43

## Do it with SMOOTH-ON


### Electric Hoist

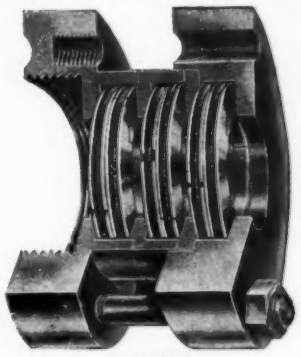
MIDGET ELECTRIC HOIST available in ⅛-, ¼-, ½- and 1-ton capacities. Unit can be carried to any place in the plant with very little effort. Unit is made in both




a-c and d-c models, and requires no extra equipment—just a place to hang, and an electric outlet to plug into. *Yale & Towne Mfg Co, Philadelphia Division, Philadelphia, Pa.*

### Pump Tank Fire Extinguisher

IN CONFORMANCE with emergency requirements of the United States government, corporation has designed new pump tank with critical materials in it reduced to a minimum. New pump tank is made in 5- and 2½-gal sizes, and has oversized air chamber, assuring mini-



# What Is the Life of FRANCE METAL PACKING

*City of Erie, Pa., Waterworks:* "The France Packing in a Holly pumping engine has been in service 32 years and is still working satisfactorily."

*Illinois Power & Light Corp., Champaign, Ill.:* "France Metal Packing used on our engines for 27 years and is still working under a pressure of 170 lbs. superheated . . . will in all probability outlive us."

*Worcester Gas Light Co., Worcester, Mass.:* "France Packing has always been tight. . . . Same compressor packed with ordinary packing required a large amount of labor to keep the stuffing boxes tight."

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- Installation Procedure
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Request France Engineers to analyze your packing requirements. There is a representative close at hand.

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Tacony Philadelphia Penna.
*Branch Offices In Principal Cities*

Original FRANCE METAL PACKING

LSI

Sarco L2SI control on chrome plating tank, Aurilyte Process Company, Newark, N. J.

50%

# SARCO Controls- Revolutionize Metal Finishing

100%

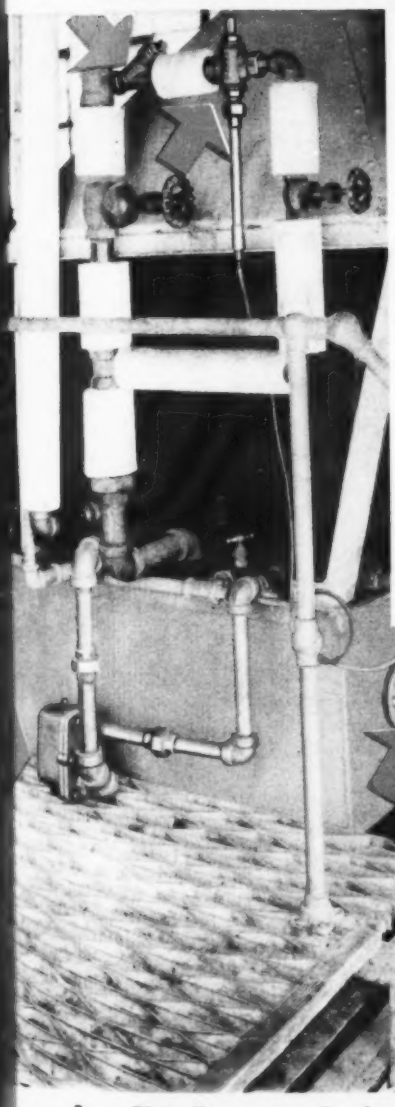
No longer need plating, degreasing, washing or other processing in metal finishing plants depend on rule o' thumb!

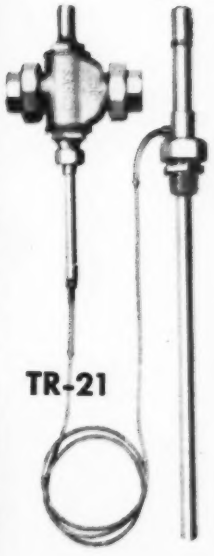
Neither is it necessary any longer to make heavy investments for intricate control equipment, difficult to keep in day-by-day operation.

Sarco has demonstrated in hundreds of plating plants that very simple, inexpensive controls can do the work—when correctly selected and applied.

Three distinct types are available, tailored to the job and ranging from combination trap controls for small tanks, to electric control for chromium plating, where temperatures are held within 1°F.

Let the Sarco man explain how you can take the guesswork out of metal finishing, speed up production, improve quality and save money besides.

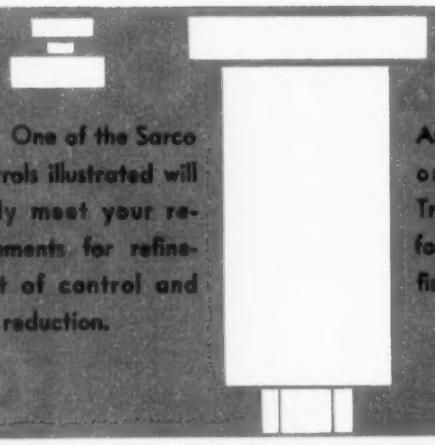




TR-21

Sarco TR-21 Temperature Regulator on continuous plating machine. Coils drained by Sarco Bucket and Float-Thermostatic Steam Traps.

One of the Sarco Controls illustrated will surely meet your requirements for refinement of control and cost reduction.



Ask for the bulletins on Sarco Steam Traps and Control for metal plating and finishing.

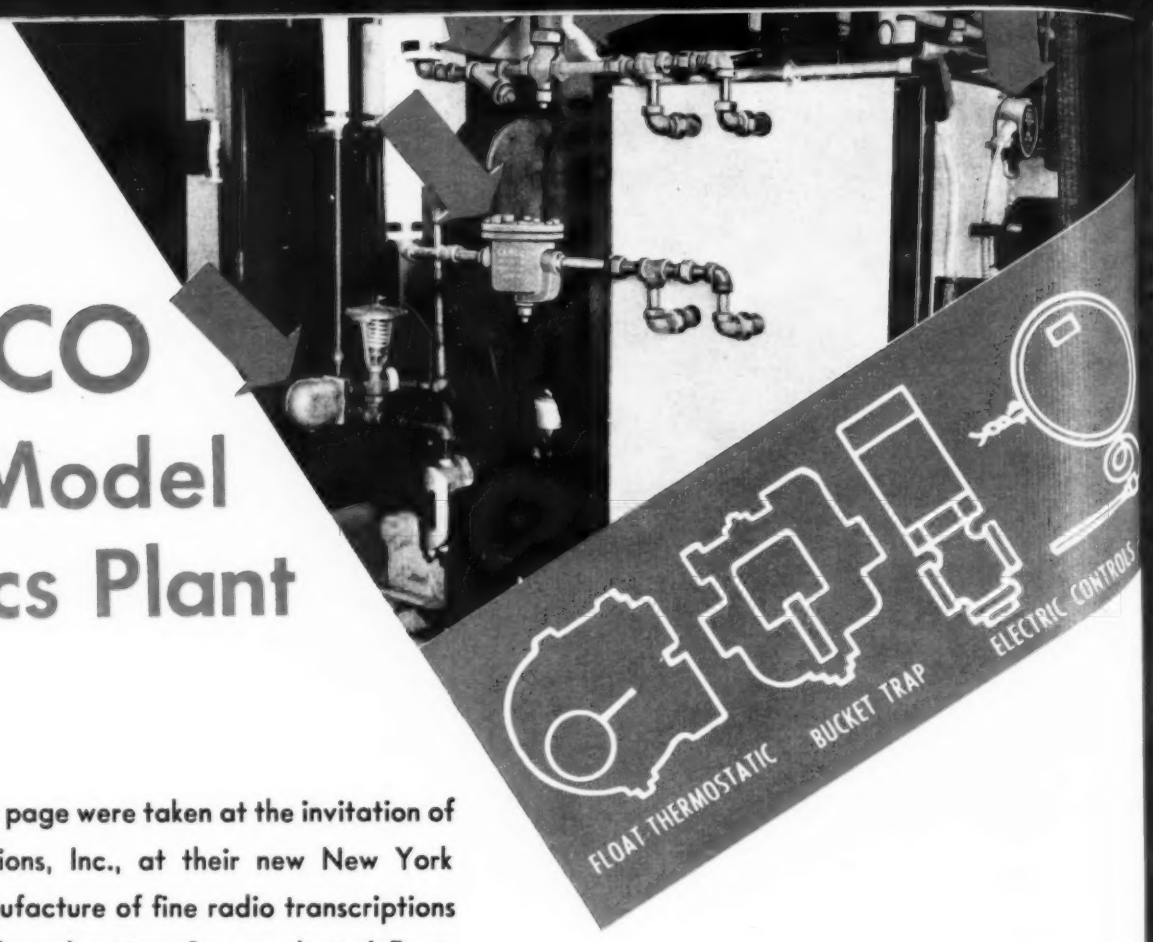
# SARCO Saves Steam

**SARCO COMPANY, INC., 475 FIFTH AVENUE, NEW YORK**

*Represented in Principal Cities*

SARCO CANADA, LTD., 85 Richmond Street, West, TORONTO, ONT.

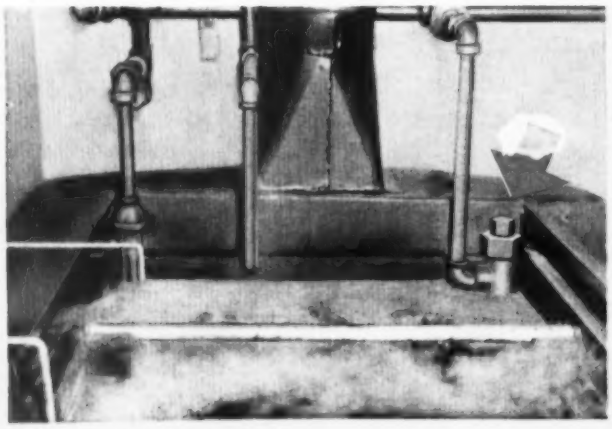
# SARCO in a Model Plastics Plant



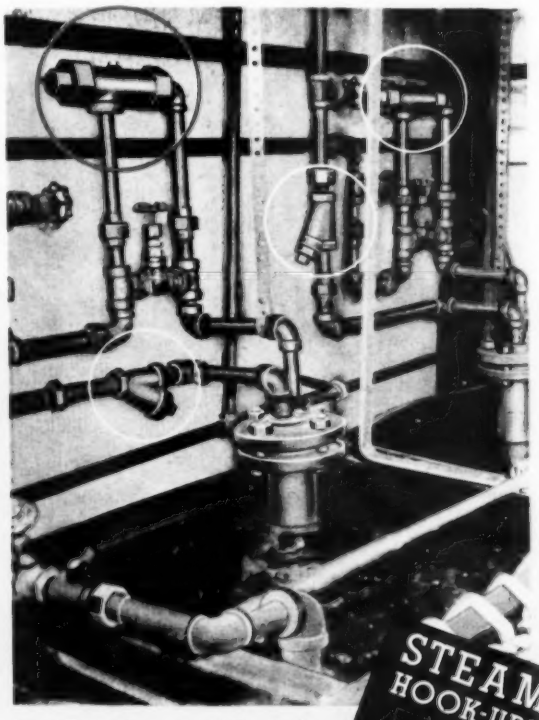

The photos on this page were taken at the invitation of Musak Transcriptions, Inc., at their new New York plant for the manufacture of fine radio transcriptions of programs for broadcasting. Sarco selected float-thermostatic steam traps for the dryer coils to secure continuous condensate removal without disturbing the temperature control; inverted bucket steam traps for the platen presses and steam lines because they can stand hard knocks; Sarco thermotons for the cleaning and plating tanks because they combine temperature control at the cost of steam traps alone. Simple Sarco type LSS electric thermostats provide temperature control for the ovens.

Sarco engineers can duplicate the results secured here in any plant where steam is used and temperature control is important. There is a representative near you. He has the advantage of four complete lines of steam traps and six different types of steam, electric and cooling water controls to offer you. His selection of the correct equipment for your plant will be based on many years' experience and the assurance that each device is made in the finest plant in the country devoted exclusively to steam traps and temperature control.

Sarco Thermoton



Sarco Thermoton on caustic tank



Sarco Thermotons, on plating tanks and Sarco strainers.

*Ask for the New Enlarged Sarco Hook Up Book.*

# SARCO Saves Steam

SARCO COMPANY, INC., 475 FIFTH AVE., NEW YORK

SARCO CANADA, LTD., 85 Richmond Street, West, TORONTO, ONTARIO

*Represented in Principal Cities*

LUBRIPLATE
SPEEDS
WAR PRODUCTION
EVERYWHERE
MACHINE PARTS ARE
HARD TO GET
You can help make the machinery you now operate last much longer without trouble, delay and expense of repairs and replacements, by using Lubriplate lubricants.

Reports from industry everywhere are telling how Lubriplate lubricants are helping to prevent shut downs and repairs. Some of these stories are almost beyond belief.

Everyone engaged in war production owes it to his Government . . . owes it to himself . . . to see what Lubriplate lubricants will do to increase his production. Lubriplate is different. It is not to be compared with ordinary oils and greases. Lubriplate arrests progressive wear. It protects machine parts against rust and corrosion. It maintains a wear-resisting protective film on bearing surfaces. There are Lubriplate lubricants to meet all operating requirements, high and low temperatures, and in the presence of water and steam. Even under certain chemical conditions Lubriplate is performing in a manner that would be impossible with most conventional lubricants. Lubriplate outlasts ordinary lubricants many times, therefore it is extremely economical.

In these war days when production is vital and machine replacement parts are hard, or, impossible to get, Lubriplate lubricants will materially help keep machines running efficiently and at reduced power consumption. Write today for copy of "The Lubriplate Film" containing much valuable information.

**LUBRIPLATE DIVISION**
**FISKE BROTHERS REFINING COMPANY**
NEWARK, N. J. **SINCE 1870** TOLEDO, O.
WRITE FOR THE NAME OF THE DEALER NEAR YOU

**Buell Dust Recovery Systems help put it there**

High Explosives are "booming" these days. America's arsenals are turning out astronomical quantities of bombs, shells and torpedoes...every one with a deadlier-than-ever "boom" for our enemies.

Sulphuric acid is important in the manufacture of explosives, but absolute purity of the acid is essential. Buell Dust Recovery Systems are used in conjunction with the contact method of making sulphuric acid because their high efficiency in removing contaminating flue dust from the sulphur dioxide gas assures purity in the finished product.

This is just one of many ways in which versatile Buell Dust Recovery Systems are helping industry achieve its war production goals by preventing contamination and salvaging critical materials for re-use. The van Tongeren "shave-off"—an ingenious design feature found only in Buell cyclones—insures exceptionally high collection efficiency, low operating cost and long life. Buell cyclones have no moving parts and require little or no maintenance or attention.

Buell Dust Recovery Systems easily handle high temperature gases, and can be installed for any desired capacity from 300 c.f.m. up.

*Memo to:*

**POWER PLANT ENGINEERS**

Buell Dust Recovery Systems, with special designs for all types of solid-fuel burning boilers, offer outstanding advantages in

*High Efficiency with Low Power Consumption*

Buell equipment is used by leading industrial and utility power plants, such as: Detroit Edison Co., Indianapolis Power & Light Co., E. I. du Pont de Nemours & Co., Curtiss-Wright Corp., Wright Aeronautical Corp., and many others.

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DUST RECOVERY SYSTEMS

*Factual 28 pg. book. Write for Bulletin P-43.*

*BUY WAR BONDS AND MAKE THE AXIS BITE THE DUST*

mum pulsations, a steady pressure, and more constant stream. Has a range of 30 to 40 ft, is a self-contained unit, and can be readily transported up ladders, over roofs, and to points difficult of access. Unit comes equipped with a standard 26-in. hose, and its interior has a corrosion-resistant coating. Both sizes approved by Underwriters' Laboratories, with a Class A-1 rating. *American-La-France-Foamite Corp, Elmira, N. Y.*

## Power Lines

(*Continued from page* 134)

time in the history of the turbine business, because of the standard steam pressure of about 400 psi which permit new tooling and machining methods on a large scale.

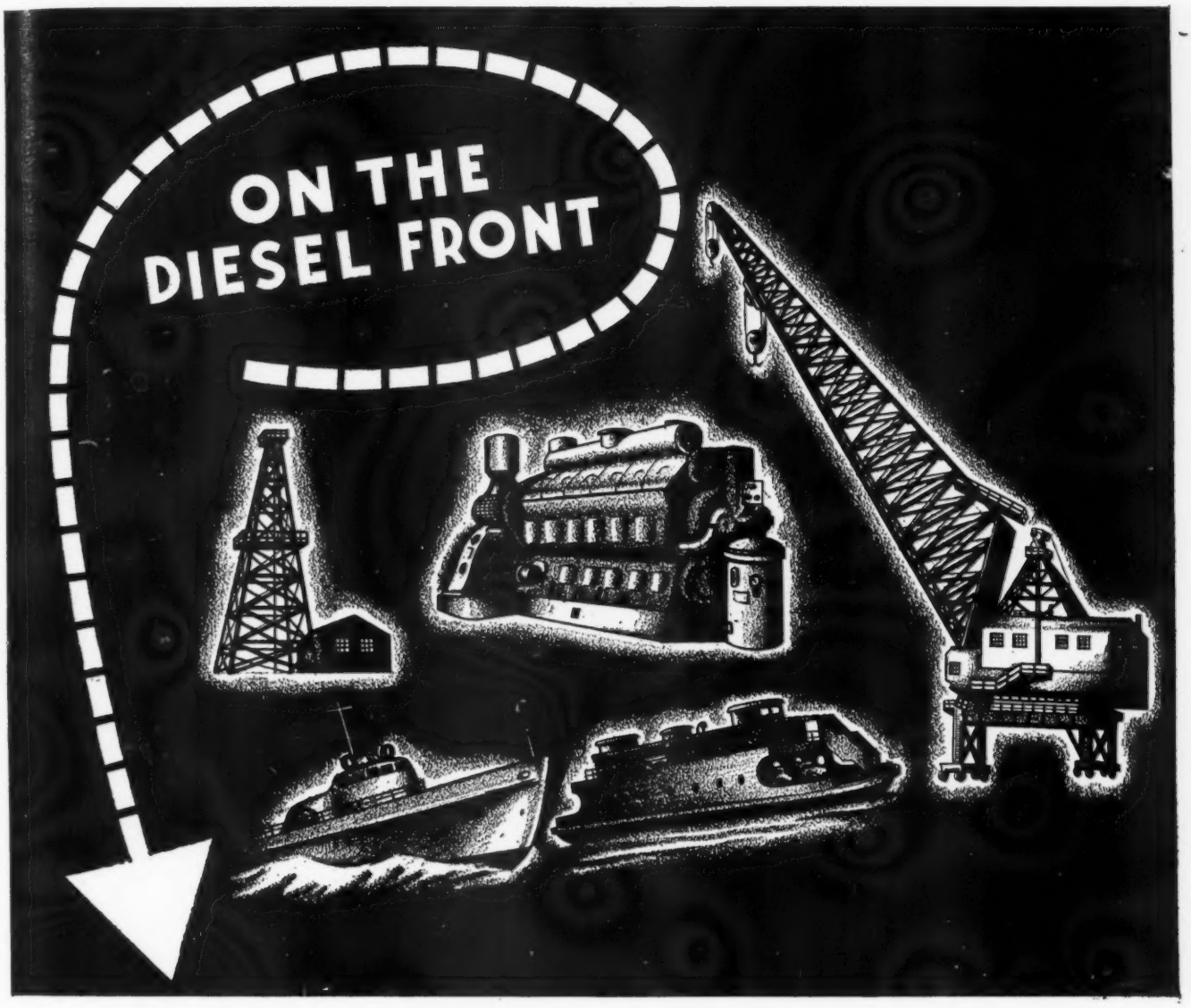
## Jan 26 Set as Conversion Deadline

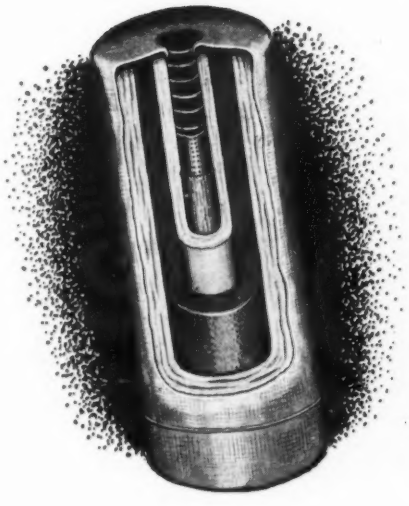
Oil-burning plants consuming 10,000 gal per year or more must be converted to coal by Jan 26, according to a recent announcement made jointly by the Petroleum Administration for War, the Office of Price Administration and the War Production Board. Large-scale users will receive no rations of oil after the deadline unless PAW certifies their inability to convert or WPB certifies that necessary conversion materials are unavailable.

However, when conversion is under way, "interim" rations may be obtained. Some 5000 large users of oil are affected by the order and more than 75% are expected to convert. The ruling applies to commercial buildings, war-production factories, apartment houses, City, State and Federal buildings, hospitals, schools and all kinds of institutions.

Recent developments increasing the seriousness of the oil situation make this new ruling necessary. It is quite possible that nonessential establishments which use oil for heating or processing may have to be closed. With supply of automatic firing equipment restricted, many conversions must be made on a hand-fired basis. Shortage of labor, shovels and other equipment necessary for hand stoking will be no valid reason for refusal to convert.

To facilitate the conversions, a PAW combustion engineer has been stationed in each WPB district office for consultation by owners. United support of all



## NOW MORE THAN EVER BEFORE . . .

Briggs Clarifiers are being used to protect engines and conserve oil. Engines today are giving top efficiency performance, and oil lasts longer . . . because of proper oil filtration by Briggs Clarifiers.

Oil is thoroughly filtered by replaceable refills made of Briggs activated Fullers Earth Blocks and Cellulose. The moulded Blocks keep the oil "refinery pure" and eliminate the most important causes of engine trouble by ADsorbing acids, resins and gums. The cellulose ABsorbs carbon, dirt and grit.

Users of Briggs Clarifiers report smooth engine operation, reduced maintenance costs, and oil savings. If you have not done so, why not install a Briggs Clarifier on your engine today?

**BRIGGS Clarifier CO.**

1339 WISCONSIN AVE. WASHINGTON, D. C.

**SPEED VICTORY BY BUYING WAR BONDS AND STAMPS**

# Beckman IS THE ONLY GLASS ELECTRODE pH EQUIPMENT PROVIDING 6-STATION pH CHECK WITH ONE INSTRUMENT

Modern boiler plant operation demands accurate pH control of the various steps in the feedwater cycle to insure optimum efficiency, minimum maintenance and operating cost!

But fullest advantage of the benefits of pH control can be had only by maintaining a continuous check of ALL of the pH-sensitive feedwater operations—sedimentation, the softening, the internal treatment, etc.

This means maintaining pH control at several different locations in the boiler plant. And this is where Beckman pH Equipment offers an important advantage found in no other make or type of glass electrode pH equipment . . . *The Beckman Multi-Electrode Switch!*

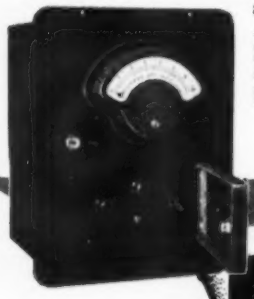
With this switch a *continuous* pH record of as many as SIX electrode stations can be maintained—*automatically*—with only ONE Beckman Automatic pH Indicator. Here's how it works . . .

The switch is completely automatic in operation and there's nothing to require the operator's attention at any time. Automatically the switch connects the first set of electrodes into the automatic pH indicator and gives time for the recorder to print the pH reading from this set of electrodes on the chart. Then the switch automatically disconnects the first station and connects in the next electrode station for recording its pH reading . . . repeating this operation on as many as six electrode stations, and then repeating the cycle over again, *continuously*, without any attention from the operator.

Even though your initial pH installation is made to control only one operation, *plan for the future* by buying Beckman equipment. This is the *only* glass electrode equipment with which you can later add other stations by simply installing an Automatic Multi-Electrode Switch. No additional indicators need be bought!

Another *EXCLUSIVE* BECKMAN FEATURE vital to power plants is the Beckman High Temperature Glass Electrode. This is the *only* glass electrode on the market that can be used for continuous measurement of the high temperature fluids found in boiler plant operation . . . another reason why you should make certain you specify BECKMAN when ordering your pH installation!

THERE IS A SIZE AND TYPE of Beckman pH Equipment for *every* boiler plant requirement. Illustrated is the Beckman Automatic pH Indicator, the most advanced pH instrument available today. Indicates pH *automatically* . . . and will operate ANY standard potentiometric recorder or control instrument for a continuous pH record or complete pH control. Ask for Bulletin 86!



BECKMAN pH CONTROL
1. Minimizes Scale
2. Reduces Corrosion
3. Improves Coagulation
4. Conserves Chemicals

NATIONAL TECHNICAL LABORATORIES
SOUTH PASADENA • CALIFORNIA

Beckman THE LEADING NAME IN pH


concerned in the program is urged and all possible assistance will be given.

## Lincoln Electric Co. Sponsors Student Project

The James F Lincoln Arc Welding Foundation of Cleveland, Ohio, on December 1, announced its first award program in the field of undergraduate engineering studies. The Foundation's new project is the $6750 annual engineering undergraduate award and scholarship program. Its object, as expressed in rules and conditions governing participation, is "to encourage engineering students to study are welded construction so that their imagination, ability and vision may be given opportunity to extend knowledge of this method and thus aid the war effort and the economic reconstruction in the peace which is to follow."

The program offers $5000 in student awards and $1750 in scholarships for the departments of the institutions in which the award-winning students are registered. Any resident engineering undergraduate student registered in any school, college or university in the United States, giving a course in any branch of engineering or architecture, leading to a degree, or any cadet registered in the United States Military Academy, United States Naval Academy, and Coast Guard Academy, is eligible to submit a paper in the award program. Further details can be obtained by writing to The James F Lincoln Arc Welding Foundation, P O Box 5728, Cleveland, Ohio

## Purdue Seeks High-Btu Gas From Coal

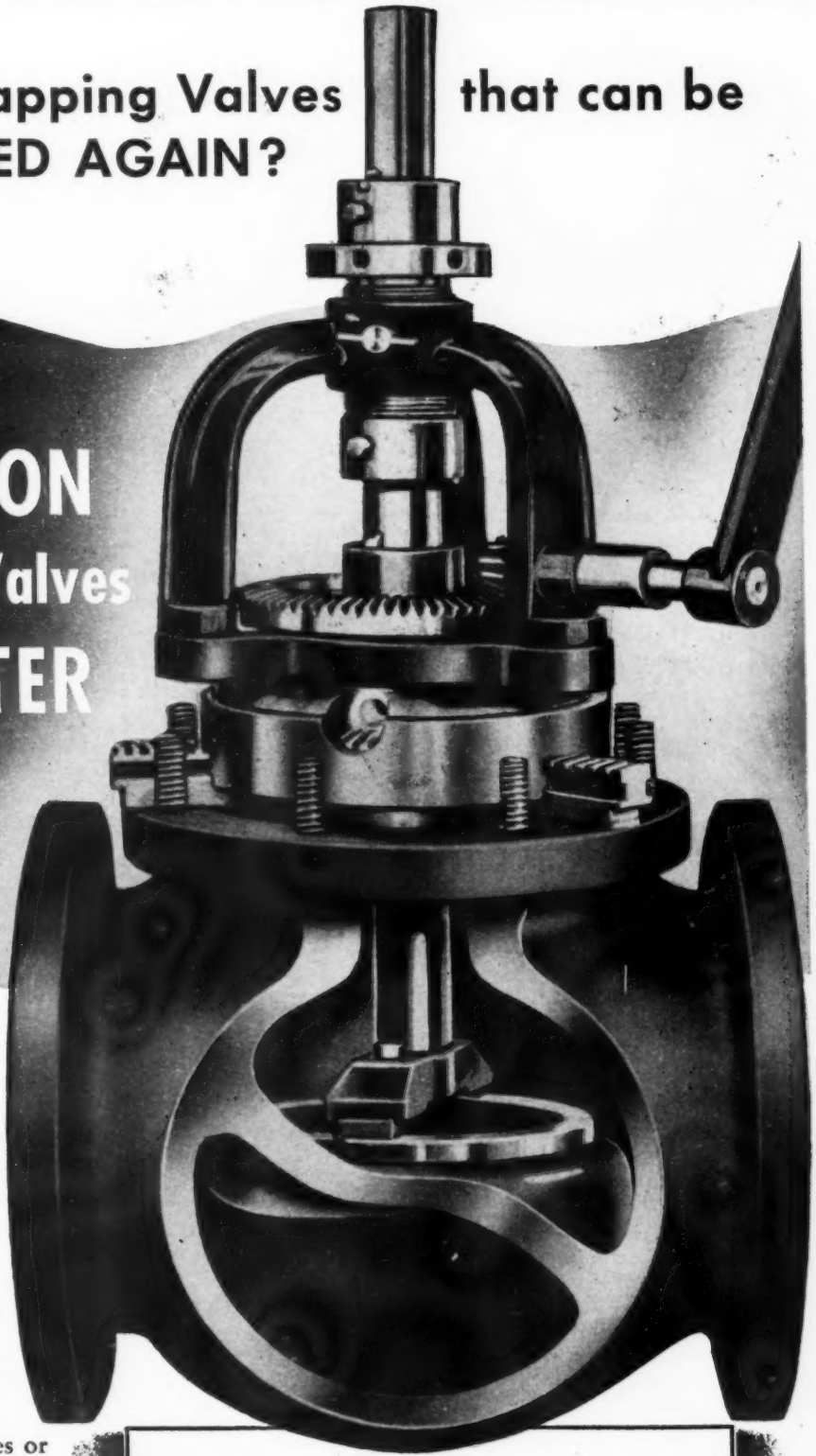
Even though heavily enriched with fuel oil, city gas made from coal generally has a heating value less than 500 Btu per cu ft. Investigators at Purdue University, Lafayette, Ind., are on the track of high Btu gas resulting from the combination of coal and hydrogen at temperatures above 750 deg F.

As announced in a recent issue of *Bituminous Coal Research*, the Purdue investigators have already "hydrogenated" coal in the laboratory by subjecting it to high pressure and temperature in an atmosphere of hydrogen.

The aim of the program is to lay the groundwork for a possible method of gas production in which coal will be completely transformed to a gas of high calorific fuel, approximating natural gas in composition and burning characteristics.

## Are You Scrapping Valves that can be USED AGAIN?

# RECONDITION
## Old and Leaky Valves
# WITH DEXTER
## Reseating Equipment



Even during these times, when new valves and parts are so hard to get, many company scrap piles contain valves which Dexter Valve Reseating Equipment can quickly *put back into good condition.*

And don't forget the proven value of Dexter Valve Reseating Equipment for keeping your working valves—*any* make or metal—in good condition *on the line.* Using Dexter Equipment, *any* mechanic can make all seats, gates or discs absolutely PRESSURE TIGHT again.

For more than *50 years,* Dexter Valve Reseating Equipment has been essential to industry. *Today,* because of the need to preserve valves and conserve power, Dexter Valve Reseating Equipment is absolutely *vital.* Write for further information today.

# DEXTER
## *Valve Reseating Equipment*

THE LEAVITT MACHINE CO., 101 EAST RIVER ST., ORANGE, MASS.

**COFFIN**-*Steam Turbine*
**CENTRIFUGAL PUMPS**

Are helping in the War Effort of

THE ARMY THE NAVY

THE COAST GUARD

THE RAILROADS PRIVATE INDUSTRY

*"On the Land and on the Sea."*

*Mail the Coupon*

We will welcome the opportunity to serve you.

PRESSURES TO— 750 LBS. SQ. IN.

DELIVERIES TO— 500 G.P.M.

THE J. S. COFFIN, JR., COMPANY
ENGLEWOOD, NEW JERSEY

*Please Send Descriptive Bulletin I-21*

NAME

COMPANY

ADDRESS

P.W.


As pointed out in the bulletin, gas produced in this way can later replace and supplement the dwindling supplies of natural gas of somewhat similar Btu value. Any attempt to substitute low-Btu city gas for natural gas causes many complications, notably decreased capacity of the distribution system.

From an economic standpoint, the use of coal as a raw material for the production of gas should be advantageous because deposits are so widespread. The use of low-cost "waste" coals in large units situated at centrally located mines will require only limited high-pressure distribution systems in contrast to our present cross-country network.

Laboratory work so far has given information regarding the relation of temperature, pressure, time of hydrogenation, etc. Gas with a heat value of 900 Btu per cu ft has already been obtained.

## OBITUARIES

GEORGE W HEALD, chief engineer of the Ramtite Co, Chicago, Ill., died on Nov 16, 142.

CHARLES R MATTHEWS, 47, for many years a heating engineer with the J F Tuttle Co, Boston, died recently. He was a native of Malden, Mass., and was educated at the engineering school of Franklin Institute, Boston.

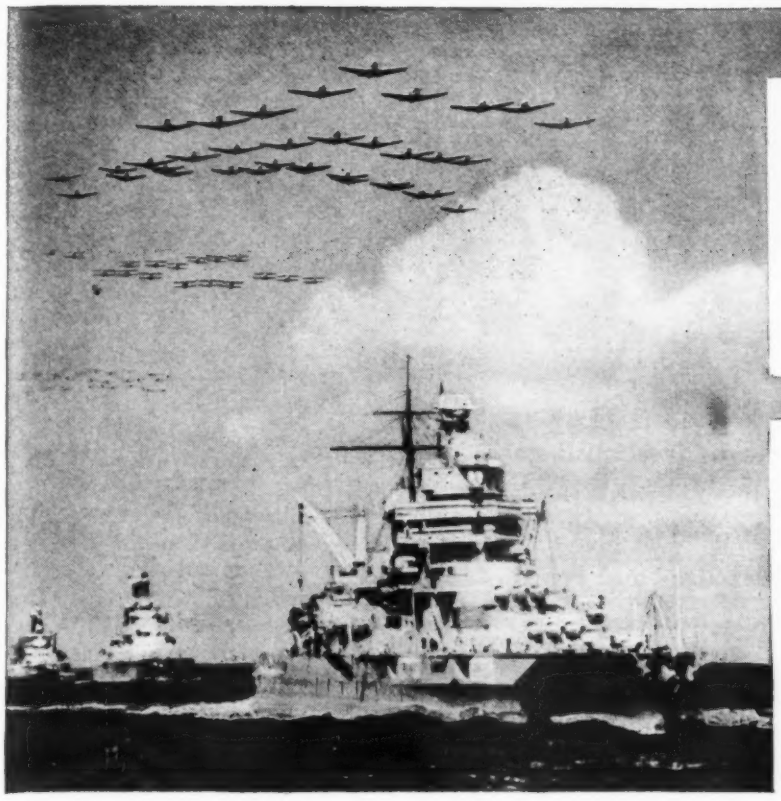
JULIUS H MUELLER, 62, treasurer and member of the board of directors of the Lombard Governor Co, Ashland, Mass., died suddenly at his home in Framingham, Mass., Nov 23, 1942.

JOHN F ROOME, 75, for 43 years employed by the Talbot Woolen Co, North Billerica, Mass., and its chief engineer at his retirement six years ago, died November 22.

GEORGE R BARR, formerly superintendent of stations for the Turners Falls (Mass.) Power & Electric Co, and past chairman of the System Operators of New England, passed away recently.

DAVIS S YOUNGHOLM, vice president of the Westinghouse Electric & Mfg Co in charge of the Lamp Div, died recently. He was 53. Mr. Youngholm joined the company in 1909 immediately following his schooling. He was assistant to the vice president in 1930, and in 1936 vice president.

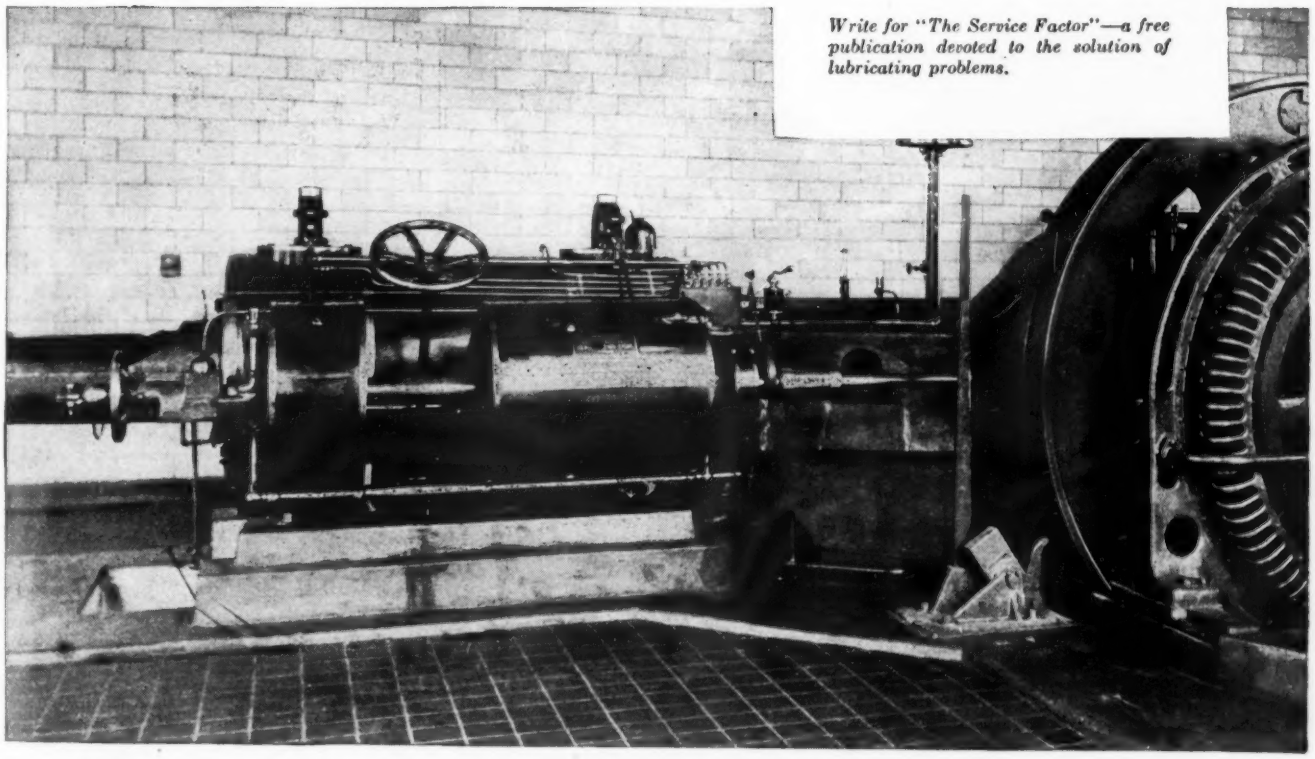
THOMAS F SCOTT, of Everett, Mass., head of the Scott Power & Light Co of



**RESERVE POWER** is as decisive *at home* as at the Front. To keep *STEAM ENGINE* output adequate to wartime power demands, use . . .

**. . . SINCLAIR STEAM CYLINDER and VALVE OILS.** These oils give wear-saving lubrication under all load conditions and *correctly* meet any combination of speed, pressure, temperature, moisture, and steam recovery requirements in steam plant operation.

*Write for "The Service Factor"—a free publication devoted to the solution of lubricating problems.*



# SINCLAIR INDUSTRIAL OILS

***FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE NEAREST SINCLAIR OFFICE***

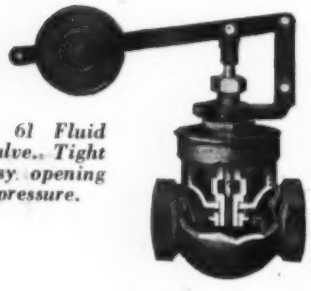
SINCLAIR REFINING COMPANY (Inc.)

2540 West Cermak Road, Chicago • 10 West 51st Street, New York City • Rialto Bldg., Kansas City • 573 West Peachtree Street, Atlanta • Fair Building, Ft. Worth

# *Liquid Level Control with* STANDARD DAVIS PRODUCTS

**ENGINEERS interested in working out the best possible liquid level control hookup will find a wide choice of units offered by Davis. The broad Davis line includes several sizes and types of float boxes, float and lever tank units, float and lever operated valves and combinations of these units for every conceivable application—direct or remote control of valves, pumps, switches, signals, indicators, etc. It may save you time and money to consult Davis first. Literature on request.**

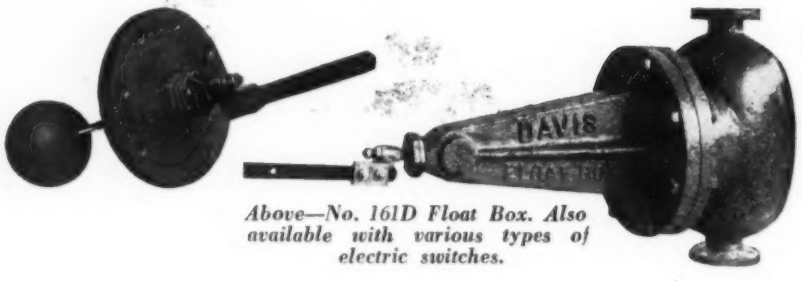
**DAVIS REGULATOR COMPANY**
**2540 S. Washtenaw Ave., Chicago, Ill.**



*Right—No. 61 Fluid Control Valve. Tight closing. Easy opening against pressure.*

*Above—No. 60 Float Valve. No hunting or water hammer.*

*Below—Float and lever unit with Dia-Ball packless unit.*




*Above—No. 161D Float Box. Also available with various types of electric switches.*

DAVIS VALVES **DAVIS REGULATOR COMPANY**


Boston, died November 25, 1942 at the age of 91.

WILLIAM SALT, for many years head of the service department of the De Laval Steam Turbine Co, died suddenly Oct 31, 1942. Mr. Salt was one of the oldest De Laval employees in point of service, having been associated with the company for more than forty years.

M LLOYD HOLLISTER, president of the W S Rockwell Co, passed away Oct 31, 1942.

BENNET B BRISTOL, who with his brother, Edgar H. Bristol, founded the Industrial Instrument Co in 1908, which later became the Foxboro Co, died at his summer home in Falmouth Heights, Mass., November 10.

W S FARISH, president and chief executive officer of the Standard Oil Co of New Jersey, died Nov. 29, 1942. Since the start of the war Mr Farish had been working continuously, serving as a member of the Petroleum Industry War Council set up by industry at the request of Petroleum Co-Ordinator for War. Mr Farish had headed Standard Oil of New Jersey since 1937.

WALTER G RUGGLES, 72, founder and president of the Ruggles-Klingeman Mfg Co, Reading, Mass., died Nov 14, 1942.

FRANK J WESCHLER, vice-president of the Chain Belt Co of Milwaukee and general manager of Baldwin-Duckworth, a division of Chain Belt Co, died suddenly Nov 10, 1942, in Worcester. In 1927 Mr Weschler became affiliated with the Baldwin Chain & Mfg Co of Worcester, Mass., as president and treasurer. Upon merger of that company with the Duckworth Chain & Mfg Co in 1930, he became treasurer and general manager of the newly formed Duckworth Chain Corp. When Baldwin-Duckworth merged with Chain Belt Co in 1939, Mr Weschler became vice-president of the Chain Belt Co and general manager of Baldwin-Duckworth, now a division of the Chain Belt Co.

ALBERT KAHN, head of the firm, Albert Kahn Associated Architects and Engineers, passed away Dec 8, 1942 at his home in Detroit, Mich. He was the noted designer of many mills, factories, power plants and other structures throughout the world. About 20 years ago he called in the key men of his organization gave them an interest in the business and began to train them to continue the work of the organization.

# The Seat Has Extra Protection in CHAPMAN'S LIST 960 SMALL GATE VALVE

This forged-steel valve won't take a licking from wear on any line from ¼" up to 2". Because the seats (yes, and plugs, too) are superhardened by an exclusive Chapman process that now adds extra years of wear-resistance to what was *already* the longest-lived small valve made. And even then, when wear does finally make its mark, these parts can be quickly and easily replaced.

In opening and closing, these valves respond instantly to even the lightest touch, for the quick-acting threads never stick or balk. And as for repacking, that can be done under full pressure with the valve in the open position. This unique small gate valve, with all its exclusive Chapman plus-values, is made in both inside and outside rising stem types, for all pressures up to 800 lb. at 750°, or up to 1500 lb. cold working pressure. Get in touch with the Chapman office or warehouse near you.

**and the PLUG of Chapman's List 960 has EXTRA PROTECTION, too...**

ARMY E NAVY

**THE CHAPMAN VALVE MANUFACTURING CO.**
INDIAN ORCHARD, MASS.

MAXIM ENGINEERING WARTIME SERVICE

*for those who cannot buy*

**MAXIM SILENCERS**

War production comes first today and we are totally engaged in work on orders that carry high priority ratings. We are keenly aware, however, that many who cannot secure these high ratings have problems pertaining to the operation and efficiency of their engines . . . problems that in many cases we can help them solve. For this reason we are offering, without any obligation, the help of our Engineering Department.

**WHAT CAN SUCH A SERVICE DO FOR YOU?**

In many cases a simple adjustment, supplying the proper length of exhaust pipe will not only actually increase the efficiency of engine operation but will also cut down considerably on exhaust noise. In other instances the method of leading exhaust out of the building decreases engine efficiency or accentuates exhaust roar. Maxim engineers with long experience in specifying the proper methods of caring for exhaust or intake lines can frequently make recommendations that will result in smoother and better engine performance. Or there may be some cases where the present silencing equipment (built in your plant, perhaps) can be made to do a better, more efficient job.

**HOW CAN YOU SECURE MAXIM ENGINEERING SERVICE?**

Write to The Maxim Silencer Company giving complete engine specifications together with a sketch of your present hook up, describing in detail your exhaust or intake piping arrangement and the specific difficulties you have encountered.

**The Maxim Silencer Co.**

92 Homestead Ave., Hartford, Conn.

MAXIM SILENCERS

Louis H Kahn, his brother assumes the post of chief administrator.

A K Fischer, president of Schutte & Koerting Co, died Nov 5, 1942. He was 72 years of age. Mr Fischer came to Schutte & Koerting Co in 1903, and in 1907 became president.

A D Skinner, president of the Skinner Engine Co, Erie, Pa., passed away recently. Mr Skinner assumed the

presidency of the company in 1922, following the death of his father, Le Grand Skinner.

It was very largely because of his ability in the fields of designing, selling and manufacturing that Skinner Engine Company has assumed its present position in the manufacture of stationary and marine reciprocating steam engines in the United States.

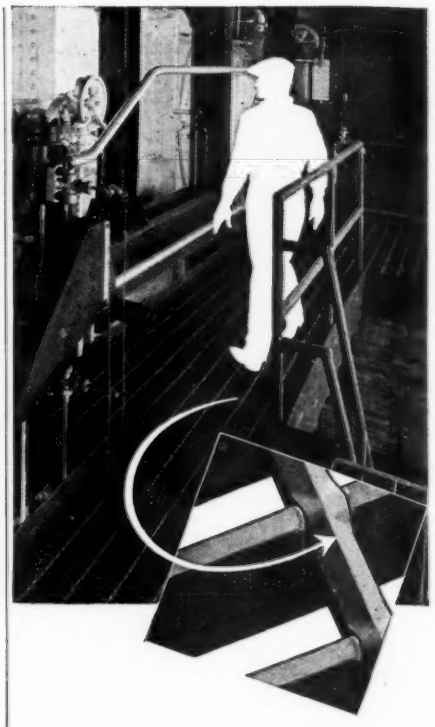
The crowning event in his life-long connection with the steam engine industry was the receipt last August of the Army-Navy "E" Award.

## PERSONALS

James H Hait, for many years chief engineer of the Peerless Pump Div, Food Machinery Corp, has been elected general manager of the new division of the corporation, to be known as the Food Machinery Corp, Division of Procurement & Engineering.

W L Buchanan has been named field manager of renewal parts sales of the Crocker-Wheeler Electric Mfg Co, Ampere, N. J.

Charles G Pyle, general sales manager of Sylvania Electric Products, Inc, has been appointed managing director of the National Electrical Wholesaler's Association. Mr Pyle has been identified with the lighting industry since 1920, when he was placed in charge of the Pittsburgh warehouse of the then Hygrade Lamp Co.



***THERE* IS WHY IT IS GOOD BUSINESS TO SEE THAT YOU GET**

**BATES-GRATES**

**FOR OPEN STEEL FLOORING**

That scraper edge on the Bates open steel flooring cross bar is cleaner and safer. You grasp the idea from even a quick glance at the picture. Yet it doesn't cost you a cent more.

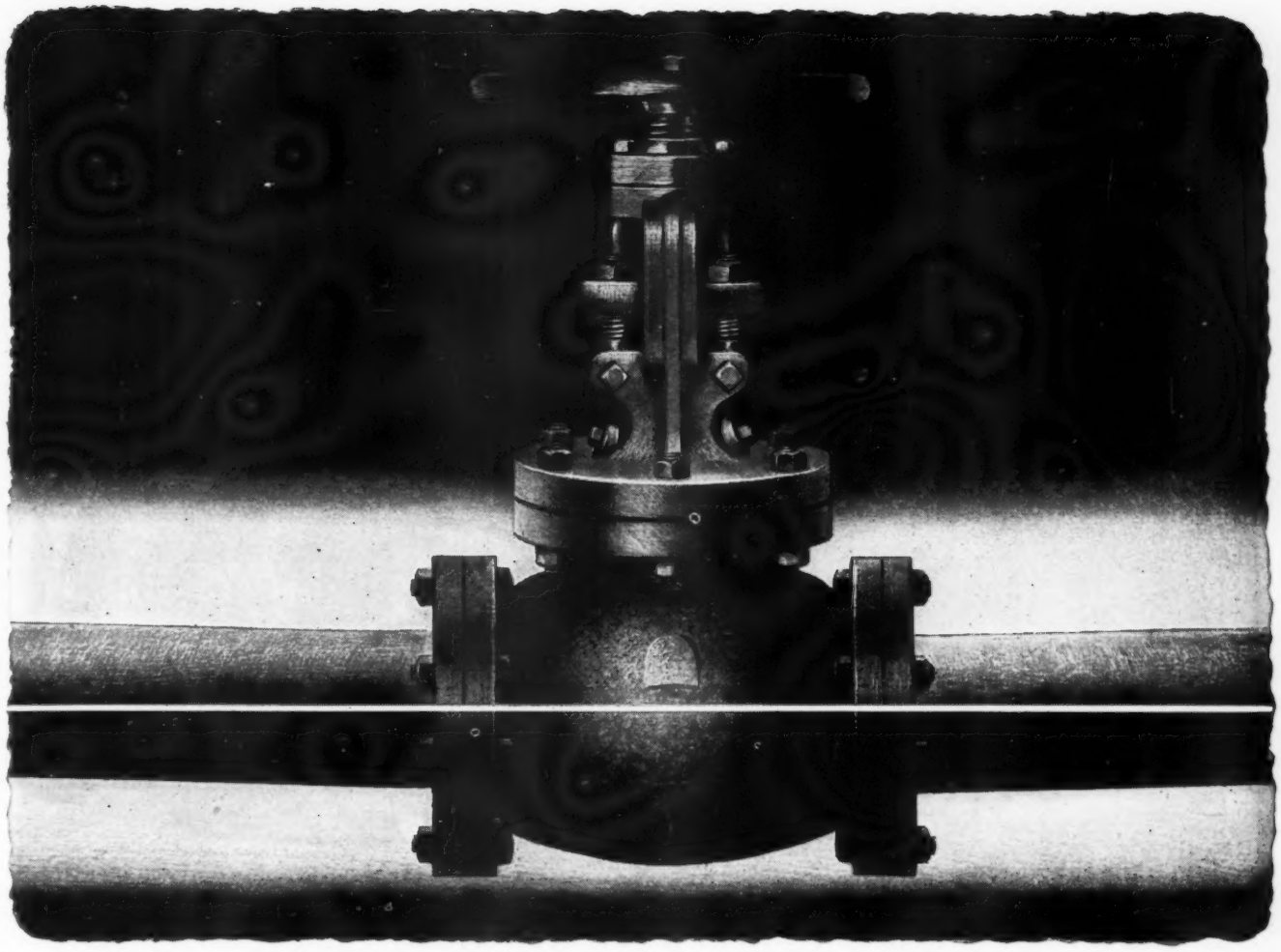
You get those extra advantages because the Bates patented process builds a fillet from displaced metal—in addition to the clean scraper tread of the "Hex" cross bar, giving you smoother, cleaner, larger welds *and stronger flooring.*

*The whole process is explained—and many fine installations pictured—in the 8½ x 11 catalog, "FILLET-WELD BATES GRATES." Write for a copy.*

**WALTER BATES COMPANY, INC.**

208 S. LA SALLE STREET • CHICAGO, ILLINOIS

*OPEN STEEL FLOORING • STAIR TREADS*



# GUARD YOUR VALVES GIVE THEM PROPER SUPPORT!

## PROVIDE EXPANSION BENDS OR JOINTS

Don't so install valves that they carry the weight, sag or expansion of the line. Valves are not designed to carry that type of load. Distortion will result in inefficient operation, jamming, and need for early maintenance. Maintenance materials, you must remember, also are on the critical list.

It might be a good idea to approach inspection of every valve with one thought, *"What's wrong with this?"* Guard your valves. They will last longer.

**Don't Use Gate Valves or Cocks for Throttling . . .**

Gate Valves and Cocks should be opened wide and closed tight. When operated otherwise they are soon ruined, giving unsatisfactory service in the meantime. Use Globe and Angle Valves for throttling.

*Write to Reading, Pa., general office, for copy of "VALVE DON'TS" —a poster for plant use that tells things NOT to do to valves.*

**READING-PRATT & CADY**

*MANUFACTURERS OF*
READING CAST STEEL VALVES AND FITTINGS
PRATT & CADY BRASS AND IRON VALVES
D'ESTE VALVE AND ENGINEERING SPECIALTIES

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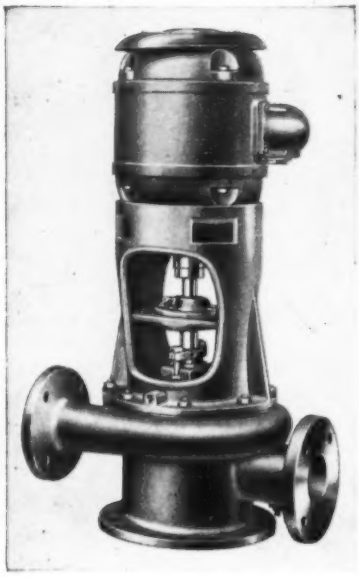
A DIVISION OF ACCO AMERICAN CHAIN & CABLE COMPANY, Inc., BRIDGEPORT, CONNECTICUT

# The Pump that's Always *Ready*



Waits only the throw of a switch for instant start or stop. It's smooth. It's quiet. And it's powerful. Ready for various and sundry applications, hot and cold water, brine, boiler feed and pressure boosting, etc. Note its compactness accessibility. Send for Catalog D2-1042.

256 pages of engineering data—of interest and value to all pump users. Write today for a free copy.

***Get this NEW Fact and Data Book***

**Economy Pumps Inc.**

**1020 Weller Ave.**

**HAMILTON . . . . . OHIO**


WALTER E GIBSON, formerly advertising manager of the Swartzbaugh Mfg Co, Toledo, Ohio, has joined the advertising staff of Detroit Rex Products Co, Detroit, Mich.

A H B JEFFORDS, management engineer with the Trundle Engineering Co for the past several years, has been made a vice-president. He will take over various administrative duties in the Cleveland office, specializing on war production rules, regulations and requirements.

WILLIAM B SKELTON, vice-president, Central Maine Power, has been elected president of the company to succeed the late Walter S Wyman. Mr. Skelton is treasurer of the Union Water Power Co and the Androscoggin Reservoir Co, Lewiston, Me., and a former public utilities commissioner of the state.

EARL B BUSENBERG, chief chemist of the Philadelphia Rubber Works Co. reclaim division of the B F Goodrich Co, has been loaned to the government to serve on the staff of technical consultants assisting William M Jeffers, U. S. Rubber Director. Busenberg will devote himself to the technical phases of reclaim rubber.

WILLIAM F LAHL, research engineer in the engineering and research division of Crane Co, Chicago, Ill., has accepted an appointment with the War Production Board in Washington, D. C. Mr. Lahl will be consultant in the valve and fitting section of the shipbuilding division of the War Production Board.

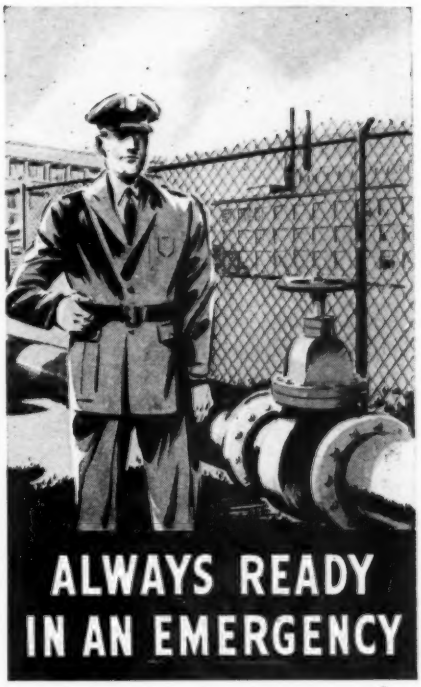
HOWARD B GRAVES has been appointed general manager of the D W Haering Co, Inc, Chicago, Ill. Mr. Graves joined the company in 1934 as senior technologist and was formerly St. Louis district manager.

E S COE, JR, has been appointed manager of the New York office of Farrel-Birmingham Co, Ansonia, Conn.

HARRY E CARLOSS has been appointed sales manager of the Deming Co, of Salem, Ohio. Mr Carloss has been with the company for the past fifteen years, being a salesman in the Memphis territory.

## BUSINESS ITEMS

CHAIN BELT CO announces the election of A R Abelt, secretary of the company, a director to replace F J Weschler of the Baldwin-Duckworth Div, who died recently. In addition to being made

**ALWAYS READY IN AN EMERGENCY**

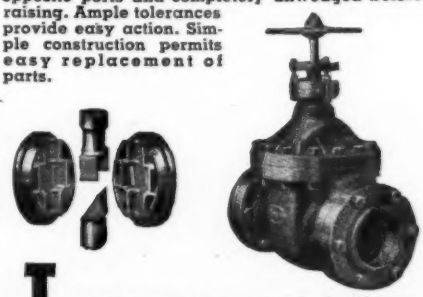
**Thousands of husky doughboys who served Uncle Sam in the last war are again on duty—as guards in vital production centers, navy yards, etc.—proof of the old adage that "You can't keep a good man down."**

**Thousands of rugged Ludlow Valves—many of them also veterans of the last war—are on duty too, in strategic power plants, factories and institutions, proof of the fact that you *can* keep a good valve down—down in the line, where it belongs! . . . . ready for any emergency. These sturdy valves employ the famous double-disc, parallel seat principle developed and perfected by Ludlow. That means they work smoothly, close securely—even after years in the open position. In peace or war, *Ludlow means value in valves.* Send for Catalog.**

**THE LUDLOW VALVE MFG. CO., INC.**

**TROY, NEW YORK**

***Construction Features.*** **Self-releasing 30° angle wedges and free-floating gates, self-adjusting to seats, afford smooth, trouble-free performance, long service. Rings are cleaned throughout stroke action. Gates are wedge-locked directly opposite ports and completely unwedged before raising. Ample tolerances provide easy action. Simple construction permits easy replacement of parts.**



**LUDLOW VALVES**

**SINCE 1866**

# THE WOOL IN EAGLE BLANKETS HAS VITAL EXTRA EFFICIENCY!

*Physically and chemically stable mineral wool does not deteriorate . . . retains effectiveness at temperatures as high as 1200° F.*

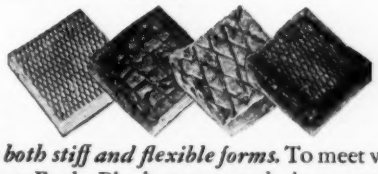
The unique properties of Eagle High Temperature Insulating Wool give extraordinarily low thermal conductivity to Eagle Insulating Blankets.

And because Eagle Insulating Wool is fire-resistant, water-repellent and non-disintegrating, the fuel conservation and production efficiencies which Eagle Blankets make possible, are maintained year after year.

Harsh service conditions and continuous temperatures as high as 1200° F. do not damage Eagle Blankets . . . do not break down their effectiveness.

Application is fast and easy. Blankets are carefully felted and secured between layers of metal fabrics. Fabricated in large sections, 2′ x 4′ and 2′ x 8′. Edges can be laced firmly together to form a tight, unbroken layer that is free from cracks and loose joints. Quickly cut on the job with tin shears to fit irregular areas or around obstructions.

*Write today for catalog sheets giving full technical data and application techniques for Eagle High Temperature Insulating Blankets.*



***Made in both stiff and flexible forms.*** To meet various requirements, Eagle Blankets are made in several styles—both rigid and semi-rigid. Metal fabrics include wire mesh, expanded lath, stucco lath and rib lath.

***Easily cut.*** Metal fabrics used in Eagle Blankets are strong and sturdy, but are readily cut on the job with sheet metal shears.

***Continuous protection.*** When adjacent edges are properly laced together, all joints are tightly sealed, assuring full protection against heat loss.

## Eagle-Picher High Temperature Insulations

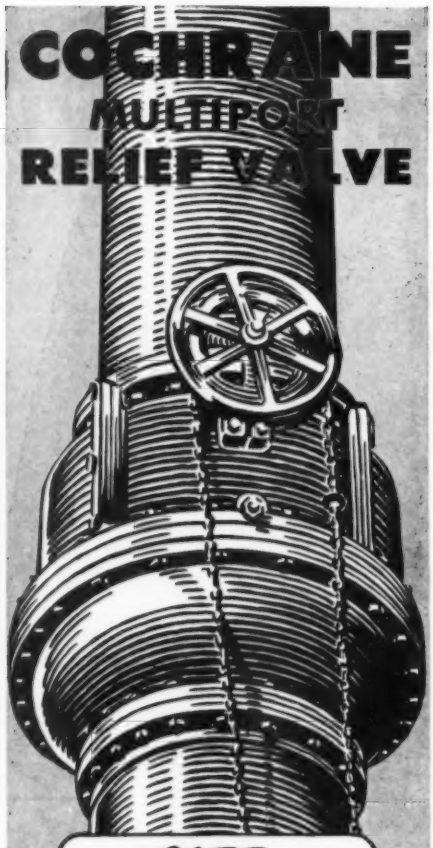
Eagle Super "66" Plastic Insulation
Eagle Supertemp Blocks
Eagle L-T Felts
Eagle Blankets

EAGLE EP PICHER

Eagle Finishing Cements
Eagle Loose Wool
Eagle Insulseal
Eagle Insul-stic

THE EAGLE-PICHER LEAD COMPANY · CINCINNATI, OHIO

COCHRANE
MULTIPORT
RELIEF VALVE



The SAFE Valve

For BACK PRESSURE
ATMOSPHERIC RELIEF
AND FLOW OR
CHECK VALVE SERVICE

Danger from sticking, jamming or freezing is eliminated by the multiplicity of valve disks instead of one large disk.

Chattering and pounding are also absent because the valve disks are light in weight with short travel and are further steadied by individual cushion chambers. Pressure is easily adjusted by varying the compression of the valve springs, which is done by shifting the pressure plate by means of a hand wheel, chain or motor.

*Write for a copy of Publication 2870*

COCHRANE CORP.
3106 N. 17th St.
Philadelphia, Pa.


a director of the company, Mr Abelt was also elected a vice-president. G D Gilbert, sales manager of the Baldwin-Duckworth Div of the company, has been made general manager of the division and elected secretary of the company to succeed Mr Abelt.

Dr Charles Allen Thomas and Osborne Bezanson were elected to the board of directors of the MONSANTO CHEMICAL CO. Dr Thomas is director of the Central Research Department of the company and Bezanson is vice-president and general manager of Monsanto's Texas Div.

YOUNGSTOWN STEEL PRODUCTS Co announces that after December 4 the Washington sales office will be located at 615 Bowen Building, 815 15th St, N. W., Washington, D. C.

MIDWEST MACHINERY Co have been appointed sales representatives in the southern part of Illinois and in the eastern and southern parts of Missouri by the Roto Co, Newark, N. J. This territory was formerly covered by the late W B Willson.

THOMAS C WILSON, INC, has announced the removal of the company's offices and plant to 21-11 44th Ave, Long Island City.

The service of the Baltimore branch office of the FRICK Co, Waynesboro, Pa., has lately been extended to include a new district office in Washington, D. C. The Washington office, which is located at 1232-3 Shoreham Bldg., is in charge of W J Dugas. A S Workman is manager of the Frick branch at Baltimore.

The first 85,000-hp unit of the Shipsaw development of the ALUMINUM CO OF CANADA was scheduled to go into operation November 20. This will be one of the largest developments in the world when all units are in service. Another unit will follow shortly after, and the others at intervals of approximately a month until the whole million-horsepower development is "on the line."

CHAIN BELT Co, Milwaukee, announces the appointment of George D Gilbert as general manager of Baldwin-Duckworth. The company also announces the appointment of William H Gates as works manager of the Baldwin-Duckworth Division.

HAHN ENGINEERING Co, manufacturers, has moved to its former address, 30 Church St, New York, N. Y.


WILL YOU BE TOO LATE?

SERIOUS trouble with Turbine Oil! Turbines threatened, power shut down imminent.

We rushed equipment, the oil was cleaned up, the danger was averted. If you own or operate a Turbine PLEASE READ THIS LETTER.

CITY OF LOGANSPORT
INDIANA

September 3, 1942.

Honan-Crane Corp.,
Lebanon, Indiana.

Attention: Mr. C. R. Crooks,
Vice President.

Gentlemen:

We wish to congratulate you on the splendid engineering design and manufacture of your Honan-Crane Oil Purifier.

We would like to cite our experience with our 5000 KW turbine which is furnishing power and light for the City of Logansport. Sometime ago this turbine began to cut-up and showed an unusually high acidity and steam emulsion number of 12001. This system carries 715 gallons of oil and we can officially say that we believe a few more days of operation would have meant a complete shutdown of this turbine and a possible high damage expense. Your purifier was installed just in time and started immediately to reduce the acidity and steam emulsion number. In 48 hours we had completely recovered the oil to a safe operating condition and in approximately one week the oil returned to its original specifications.

Since this time we have allowed the purifier to operate about 8 hours a day and we feel that it has cleaned the lines and the turbine system from sludge and varnish which naturally builds up in a system without the proper purification. In the case mentioned above, I am using two different companies' oils in my 7500 KW and 5000 KW turbines. We have Honan-Crane Purifiers installed on each turbine and have obtained the same outstanding results in both cases.

Respectfully,

Fred W. Howard
Fred Howard, Chief Engineer

Russell F. Leonard
Russell F. Leonard, Mayor

• Logansport, Indiana, is close to us, it was possible to rush equipment instantly—play safe—get Honan-Crane "Continuous" Oil Purifiers for your Turbines before trouble strikes.

Honan-Crane "Continuous" Oil Purifiers will remove all types of contamination from Turbine or Hydro-Electric Generator Oils. It gives you absolute control over acidity and Steam Emulsion in these oils.

*Write for Bulletin 300T for complete information.*

HONAN-CRANE CORP.
1200 SIXTH STREET
LEBANON, INDIANA

# ALL PLANS ARE AVAILABLE FOR THIS EDGE MOOR

*Complete installation service is available through Edge Moor including Boilers, Superheaters, Water Walls, Economizer and Air Preheater.*

## *FOUR-DRUM BENT TUBE BOILER UNIT*

*assuring prompt duplication*

•

This unit is one of three 695 h.p. boilers built for the Bedford Pulp & Paper Co., Big Island, Va. Working pressure, 400 lbs.; superheat, 100°; furnace volume, 5,600 cu. ft.; maximum rating 300%; water walls, 356 sq. ft.

Edge Moor can duplicate this equipment quickly because availability of working plans assures elimination of delays incident to the development of new designs.

**EDGE MOOR IRON WORKS, INC.** 30 ROCKEFELLER PLAZA NEW YORK, N. Y.

KANSAS CITY CHICAGO DETROIT RICHMOND, VA.

*IN CANADA:—* UNITED STEEL CORPORATION, LTD., TORONTO, MONTREAL

# This Book is Yours .. FREE

**Combustion Efficiency as applied to Boiler Plant Operation. Fuels and Equipment is now a most important factor in Defense work. Fuels cost more than ever before. Boiler loads are heavier. A scarcity of some kinds of fuel is apparent.**

**The Combustion trained man — the Hays trained man—can do his part, and open up big opportunities for himself that never existed before, by devoting a little of his spare time in training himself to meet present conditions.**

**How? Through the simple, easy reading, *practical* Hays Home Study Course in Fuel and Combustion Engineering. For 26 years the Hays Institute has specialized exclusively in training in Combustion Efficiency. Hundreds of Hays trained men now hold substantial positions of responsibility. What we have done for them we can do for you, in your spare time. Many companies urge their men to enroll. They know the value of Hays Combustion Training.**

***Just a Few of Our Hundreds of Friends***

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Armour and Co. 75
Combustion Engineering Company .....45
Riley Stoker Corp. .....75
Iron Fireman Mfg. Co. .....35
Commonwealth Edison Company .....14
State of Illinois.85
Cities Service (Oil & Power).70
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Please send me your Free Book "Opportunities for the Combustion Expert"—No Obligation.

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City..... State.....

Company Name.....


C Lee Cook Mfg Co, Louisville, Ky, announce the appointment of T V Sords as their representative in Cleveland, to succeed the late Fred M Harmon.

American Engineering Co, Philadelphia, announces the retention of Prof E L Midgette as consultant for the company in its multiple activities. Professor Midgette assumes his new duties at once, but remains at his post as professor of machine design at the Polytechnic Institute of Brooklyn.

Sauerman Bros Co, Chicago, announces the appointment of J R Norton, New York, as distributor to succeed the late W R Elden.

Yarnall-Waring Co, Philadelphia, Pa., announces the appointment of W R Hancock, 935 Park Ave, Rochester, N. Y., as their sales representative in the Rochester district.

Mathieson Alkali Works, 60 East 42nd St, New York, N. Y., announces the retirement of John A Kienle, vice-president, director of sales, on November 18. Mr Kienle joined the Mathieson Alkali Works as manager of sales in 1920, and was elected to his present position in 1922. Esse E Routh has been elected vice-president and director of sales to succeed Mr Kienle. Robert J Quinn becomes assistant to the vice-president—director of sales, and D W Drummond has been appointed general manager of sales.

Westinghouse Electric & Mfg Co announces personnel changes: Russell L Whitney has been appointed sales manager of the company's transformer division in Sharon, Pa. Mr A C Farmer, formerly assistant sales manager, has been named assistant to the vice-president, and A P Bender, formerly sales manager, has been made assistant sales manager. Chester D Moore has recently been appointed industrial relations manager of the Sharon transformer division. Angus G Scott has recently been appointed sales manager of the Derry, Pa., porcelain department of the company.

General Electric Co, Schenectady, N. Y., announces that Thomas J Mulvey has been appointed production manager of the River Works at Lynn, Mass. Carl A Salmonsen has been appointed assistant manager of the Lynn, Mass., River Works of the company. He has been with the company since 1909. George M Stevens and Nicholas M Du Chemin have been appointed acting manager of the River Works and


# YOURS FREE for the asking!

## 24 pages of "know-how" de-scaling data!

Because power plant equipment must operate at peak efficiency today, you will find this NEW, 24-page manual particularly valuable It describes how SAFE, fast-working Oakite Compound No. 32 can help you (1) shorten shut down time, (2) conserve needed man-power, (3) increase operating efficiency, and (4) save money in removing insulating lime-scale and rust deposits from such water-cooled or water-circulating equipment as

**Compressors** — **Oil Coolers**
**Feedwater Heaters** — **Jacket-Water Coolers**
**Condensers** — **Evaporators**
**Fuel Oil Preheaters** — **Transformer Cooling Coils**
**Diesel Engines** — **Heat Exchangers**

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Your FREE copy of this helpful, informative manual is ready for mailing. Send for it today!

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**23A Thames Street, New York, N. Y.**
*Representatives in All Principal Cities of the United States and Canada.*

OAKITE
*Specialized cleaning*
MATERIALS & METHODS FOR EVERY CLEANING REQUIREMENT

# Some Men Build Planes with a Bulldozer

While the American construction industry has been performing fabulous feats of building, prophets have been predicting that "next year," war building would be all done, and the construction industry would retire, deflated, to the sidelines.

In 1940, the lull was to come in Spring, 1941. Then it was to come in Winter, 1941-42. Then in Spring, 1942. But this industry forges on and on, running up buildings, cutting down time, breaking records.

Construction last year probably reached twelve billions. That outstrips anything ever seen. But already, post-war planners figure that a twenty-three billion dollar construction year is not hard to foresee in peacetime years. Already the backlog of unbuilt homes, postponed commercial buildings, and delayed public improvements is running into billions.

Koppers is grateful that it has been able to contribute to the construction industry's records by manufacturing and supplying pressure-creosoted and salts-treated timber required for war factories, hangars, defense housing, piers and other construction.

For one war factory roof alone, Koppers shipped 200 carloads of coal tar roofing. Koppers waterproofing has gone into ammunition igloos . . . important Koppers ingredients have gone into the plastics which bond the layers of plywoods now used in such volume . . . Koppers road tars have built access roads to war factories and army camps. These are but a few examples of peacetime products satisfying vital wartime needs. Koppers Company, Pittsburgh, Pa.

Buy United States
War Bonds and Stamps

**KOPPERS**

**THE INDUSTRY THAT SERVES ALL INDUSTRY**

# Scrap a pound and save 4 more

EACH pound of scrap used in making war steel replaces a pound of pig iron.

To make one pound of iron requires nearly four pounds of ore, coal and limestone.

So when you turn in a pound of scrap you also conserve four pounds of vital raw materials. Translate this saving into terms of the 6,000,000 tons of steel scrap that the industry needs today. It is the equivalent of:

12,000,000 tons, or 240,000 carloads of iron ore,

7,200,000 tons, or 144,000 carloads of coal,

3,000,000 tons, or 60,000 carloads of limestone.

Think also of saving the millions of man hours of labor involved in mining, transporting and processing these 444,000 carloads of raw materials — enough to form a solid train stretching from Boston to San Francisco.

The more dormant scrap YOU salvage, the greater the amount of America's materials, machines and manpower is released for the all-important task of winning the war now.

FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

THROW YOUR SCRAP V YOUNGSTOWN INTO THE FIGHT

*THIS ADVERTISEMENT SPONSORED BY*

**THE YOUNGSTOWN SHEET AND TUBE COMPANY**

*Youngstown, Ohio*

25-43E

## Pomonas Require only a Fraction the Space of Other-type Pumps

**SAVE SPACE ON LOCATION:** Check over your Pomona installation. It may be that it was simply set into the area occupied by your former pump with little thought given to maximum space utilization. Can you move your Pomona to an out-of-the-way corner—or into a space too small for other equipment—and thus gain added floor space for new equipment?

**USE TOP-OF-TANK SPACE NOW WASTED:** If your Pomona is not now located over the sump or tank from which it pumps, why not put it there? This space is generally wasted with other-type pumps because of their excessive weight and the difficulty of setting rigid foundations over a sump. But Pomonas need no heavy foundations—in fact, just two timbers anchored across the top of the sump is usually sufficient support for these compact self-balanced pumps. So by relocating your Pomonas over the sump or tank, you can gain solid floor space for other heavy-duty purposes.

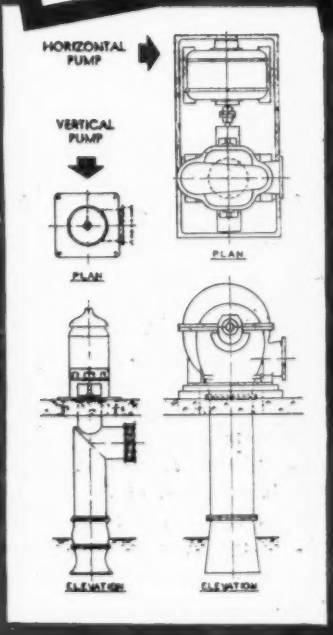
## *Make the most of this feature!*

**TODAY'S big problem is how to increase productive output with minimum expansion of plant space. Pomona Pumps not only pump water more efficiently at less cost, but they save 80% of the floor space required by other-type pumps of the same capacity. That's a BIG saving!**

If you are now a Pomona owner, you already know the *many* savings Pomonas have made in your pumping costs. But it may be you can get still greater returns from your Pomona investment by taking fuller advantage of its space-saving compactness . . .

**ELIMINATE SPACE-WASTING PIPING:** Another important way you can save space with Pomonas is by running all piping either below floor level or overhead, thus leaving the floor space open. You can do this with Pomonas far more easily than with other types because their positive-lift characteristics eliminate need for a fixed level discharge in relation to pump position.

**UTILIZE REMOTE LOCATIONS:** Still another important space-saving feature of Pomonas is that the impellers are at water level and require no priming to start. This not only eliminates space-consuming priming equipment but—even more important—enables you to place Pomonas at remote out-of-the-way locations and operate them automatically with only infrequent attention. That leaves more floor space free in the center of the plant for equipment that requires the operator's constant attention.




### Pomonas Use 1/5 The Space —Weigh Half As Much!

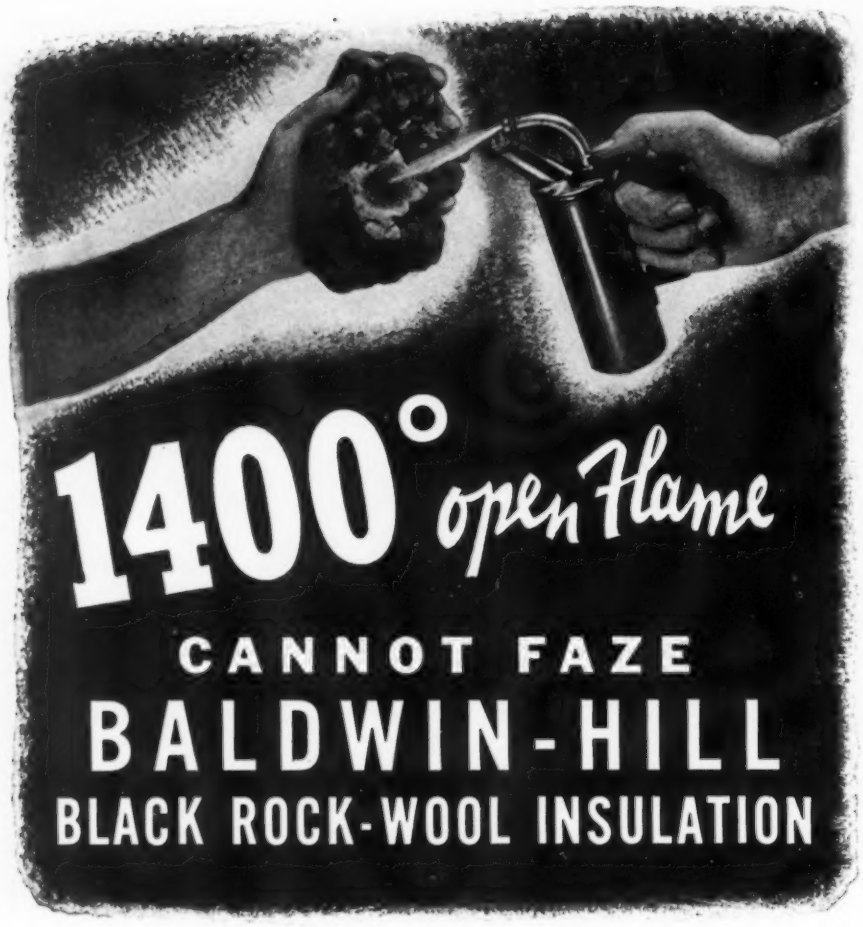
The drawings at left, both the same size, show how a Pomona Vertical compares with a horizontal centrifugal handling identically the same capacity and head. Note the floor space required—36 sq. ft. for the centrifugal, 16 for the Pomona—a direct saving of 80%.

Notice the simple, compact lines of the Pomona compared with the higher, broader, more complicated centrifugal. Note the Pomona below-floor discharge, leaving the surface around the pump clean and pipe-free. (Pomona discharge can also be at, or above floor level.) And notice in chart below how the Pomona not only saves 80% of the floor space, but weighs only about half as much—with fewer parts to service. These are the kind of dollar-saving, space-saving facts-as your Pomona owners have in your pumps. Use them to full advantage!

These are only a few of the many ways you can save valuable plant space with Pomonas. Have your nearby Pomona dealer check your installations for ways you can get maximum benefit from the space-saving features in Pomonas! Call him today.

POMONA PUMPS

POMONA PUMP CO., 320 Broadway, New York City. Plants located at 4241 South Soto Avenue, Los Angeles, and 206 Commercial Street, Pomona, California.

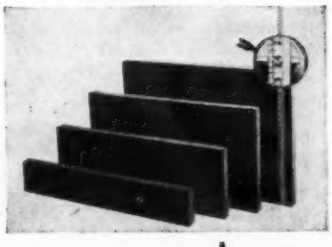



THE HIGH-IRON, low-alkaline nature of Baldwin-Hill rock wool is undisturbed by temperatures as high as 1400°. Exposures which completely remove the resiliency and strength from ordinary rock wool, flames which eat right through white wools, don't touch the strength or insulating power of Baldwin-Hill products. Add to that their stability in the presence of moisture, and you have two vital reasons for investigating Baldwin-Hill wools, felts, blocks, and cements—at once.

B-H

**FREE TO POWER-PLANT MEN**

A generous sample square of Baldwin-Hill Mono-Block, the one block for all temperatures up to 1600°, together with a sample of B-H Bond-Tite, the easy adhesive which makes wiring unnecessary. Test for yourself the heat-resistance, the extraordinarily low conductivity, the quick adhesion, and ease of cutting of this universal insulation. Just write us on your letterhead.



BALDWIN-HILL *Insulations*

575 KLAGG AVE. NEW YORK CHICAGO TRENTON, N. J. KALAMAZOO


the West Lynn Works, respectively, of the company. Mr Stevens and Mr Du Chemin succeed the late Nelson J Darling, who was manager of both plants for several years.

## CURRENT ARMY-NAVY AWARDS

National Supply Co, Superior Engine Division. Maritime "M" award presented Dec 17 at Springfield plant.

Henry Disston & Sons, Inc. Award presented Dec 2, 1942.

A Schrader's Son Division, Scovill Mfg Co. Award presented Nov 17, 1942.

Union Asbestos & Rubber Co. Award presented November, 1942.

Crane Packing Co. Second award presented Nov 23, 1942. (Original award made in the spring of 1942.)

Owens-Corning Fiberglas Corp. Awards presented to Newark and Ashton plants Nov 6, 1942.

Homestead Valve Mfg Co. Maritime "M" award presented Nov 7, 1942.

A P Green Fire Brick Co. Maritime "M" award presented Nov 10, 1942.

Clarostat Mfg Co. Award presented Nov 13, 1942.

Edwards Co, division of Rogers Diesel and Aircraft Corp. Award presented Nov 30, 1942.

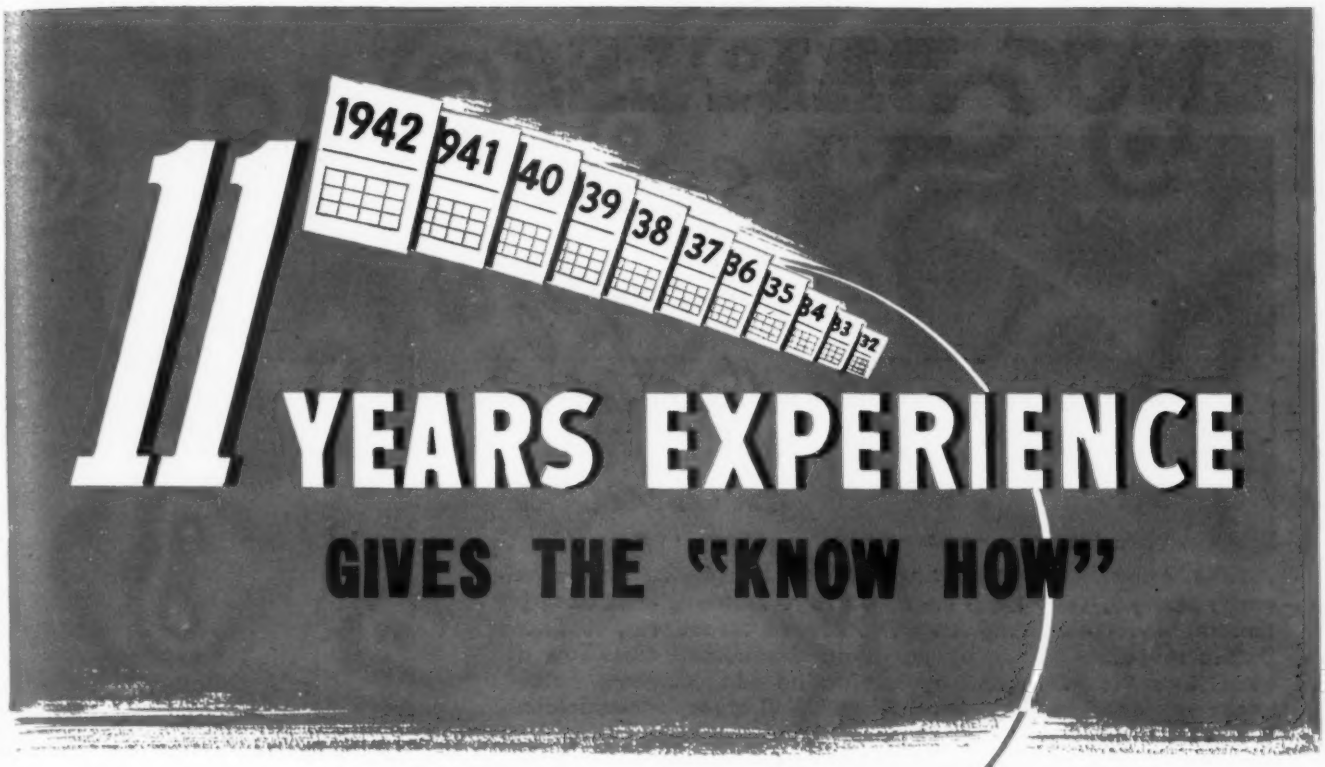
Bantam Bearings Corp. Award presented Nov 27, 1942.

New Departure Division of General Motors Corp. Awards presented to the Bristol and Meriden plants, Nov 24, 1942.

## High-Frequency Heating Conserves Critical Tin

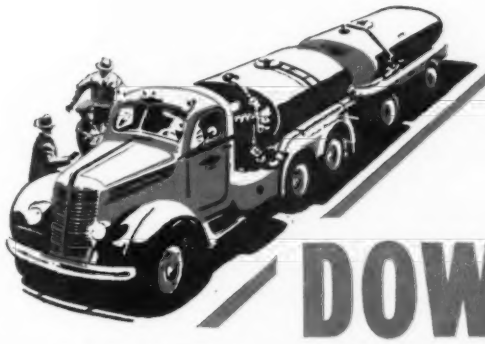
At a recent meeting in Baltimore, Md., a group of technical editors and engineers were shown by the Westinghouse Electric & Mfg. Co. how high-frequency heating at 200,000 cycles per second melts tin electrolytically deposited on a steel sheet as it passes through a rectangular shaped coil of a few turns. Already at work in one steel mill, this latest result of electronic research flows 12 sq ft of tin in 0.7 sec, much faster than was previously practical with gas furnaces or huge vats of hot oil.

This high-frequency method of fusing tin makes practical the final step in




# 11 YEARS EXPERIENCE

## GIVES THE "KNOW HOW"



# DOWELL

## INDUSTRIAL CLEANING AND SCALE REMOVAL SERVICE

*More power for production—less down-time—safety and longer life for present equipment*—these are the advantages chemistry offers in cleaning heat exchange surfaces.

Dowell Industrial Cleaning Service makes use of chemical solutions for the disintegration and removal of deposits which coat heat exchange surfaces. *This is not a feed-water treatment.*

The "know how" for this service comes from more than eleven years of experience in handling large volumes of chemicals, which are used by the Petroleum Industry to increase production from oil and gas wells.

In industrial cleaning work specially designed trucks are used for transporting and handling the chemicals. Pumps circulate chemical solutions to all points where steam or water flow. Costly time-consuming dismantling of equipment is unnecessary.

For information write Dowell's Tulsa office.

DOWELL INCORPORATED

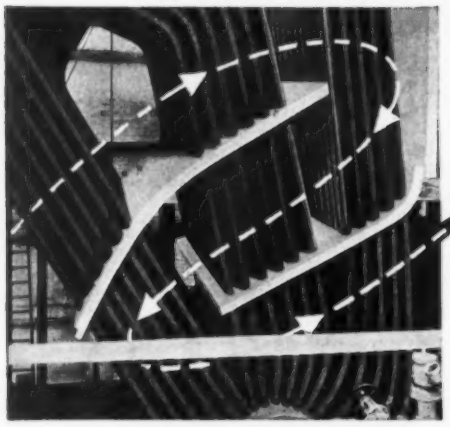
Executive Office: Midland, Michigan
General Offices: Kennedy Bldg., Tulsa, Oklahoma
Subsidiary of The Dow Chemical Company

Look to

DOWELL

FOR INDUSTRIAL CLEANING AND SCALE REMOVAL SERVICE

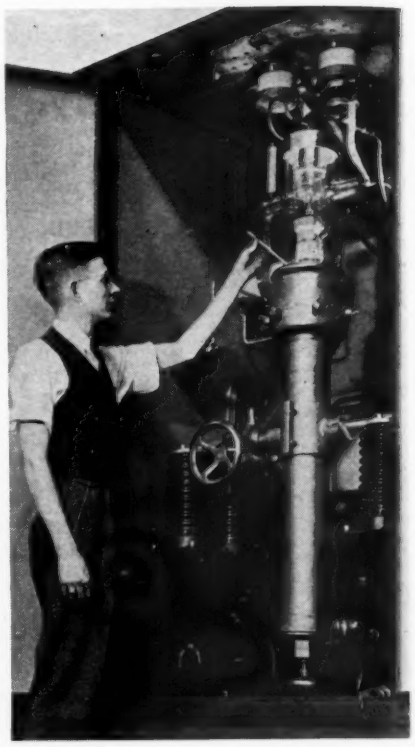
# ENCO BAFFLES



*Satisfy Hungry Heating Surfaces*

...and many boiler heating-surfaces are literally and unnecessarily starved. They need Enco Baffles to increase heat absorption, to boost efficiency and to increase steam output. Enco Baffles revitalize boilers by providing streamlined cross-flow of gases over the tubes, and by eliminating eddy currents, bottlenecks and dead gas pockets. Bulletin BW40 gives further details. It is yours on request.

**THE ENGINEER COMPANY**
75 WEST STREET (Enco) NEW YORK, N.Y.

This 100-kw vacuum oscillator tube supplies high-frequency power to the inductor heater coil where sufficient heat is generated to flow electrolytically deposited tin plate. These tubes are essentially the same as those used in radio transmitters

Write for Working Sample
Send for 36 page catalog.

## Put "AMBEST" to a long life test on any tough job

This UNIVERSAL packing—of long, pliable, anti-friction metallic alloy strands—assures low cost, long life packing protection and easy application on any rod in good condition. "AMBEST"—available for all pressures and temperatures up to 550° F.—is recommended for pumps, compressors, engines, throttles and valve stems. All needs are supplied by one packing when you use "AMBEST."

"EUREKA"

**EUREKA PACKING CO.,** 294-296 46th St., BROOKLYN, N. Y.

## *QUICK ANSWERS . . .*

**to your most troublesome questions on**

mechanical engineering and applications

Here are 2276 pages of data constantly needed by engineers, machinists, designers, draftsmen, plant and shop employees in every branch of mechanical engineering. Arranged in handy reference form are answers to thousands of questions of every type—covering theory, standards and practice—compiled by experts in many lines.

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electrolytic tinning which saves two-thirds of the war-scarce tin. The electrolytic coating of only 30 millionths of an inch on each side of the strip, or less than one-hundredth the diameter of a human hair, cuts 60 millionths of an inch off the coating applied by the old hot-dip process. Additional saving in both tin and steel sheet may be realized by high-frequency heating, since no waste is encountered from scoring or from marking the sheet by either electrical or mechanical action. In the induction system it is possible to melt and quench the tin plate between guide rolls. As the power input to the inductor coil, which determines the amount of heat generated, can be immediately and automatically adjusted to correspond with any change in speed of the strip, the proper temperature to melt the tin is maintained and oxidizing of the strip eliminated.

In answer to the problem of boosting output of tin plate to keep pace with the rapidly-growing requirements of our armed forces, high-frequency heating equipment is being designed to operate at speeds up to 1000 fpm. while gas furnaces are limited to 150 and hot oil to 200. At present electrolytic plating is operated at a maximum of 500 fpm, but in the near future this speed will be

# At every temperature from Sub-Zero---to 2500° F.

# Carey HEAT INSULATIONS OUTSTANDINGLY DEPENDABLE

(*Above*) For High Temperature Equipment (1000°F to 2500°F) Carey Hi-Temp No. 19; Calcined Aggregate; Dicalite Insulating Powder

(*Below*) For Superheated Surfaces (600°F to 1500°F) Carey Hi-Temp No. 15; Vitricel; Rock Wool Blankets

There is a CAREY Insulation for *every need*. The complete Carey Line offers you the assurance of maximum efficiency *at every point* where equipment or distribution lines can waste heat.

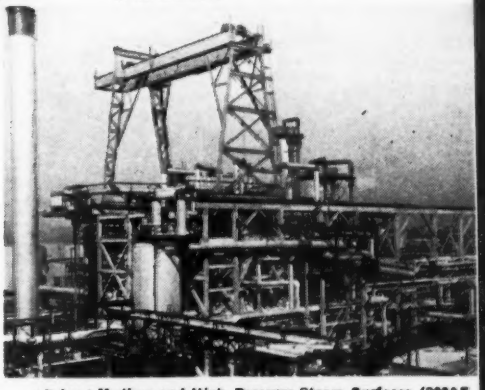
Perfected through years of research and experience, Carey Insulations reduce fuel consumption to the minimum; stand up under modern temperatures and pressures. Today they are giving outstanding service in the highest-pressure power plants in America; in hundreds of other plants that are noteworthy for efficient generation of power.

Whether you need insulation for 2500° F.; for sub-zero; or any intermediate temperature; you're SAFE with CAREY. A nationwide distribution and engineering organization is at your service. For details, address Dept. 16.

**THE PHILIP CAREY MFG. COMPANY** • **Lockland, Cincinnati, Ohio**

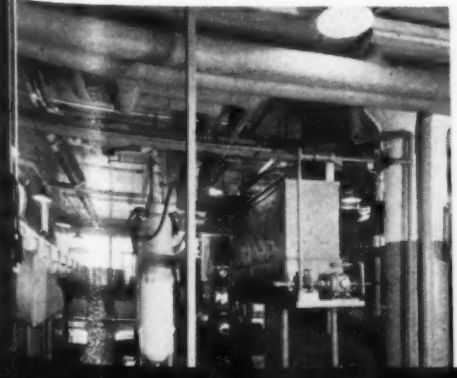
***Dependable Products Since 1873***

**In Canada: THE PHILIP CAREY COMPANY, LTD., Office and Factory: Lennoxville, P. Q.**

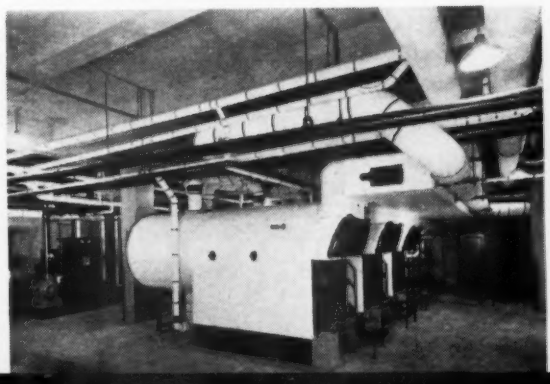


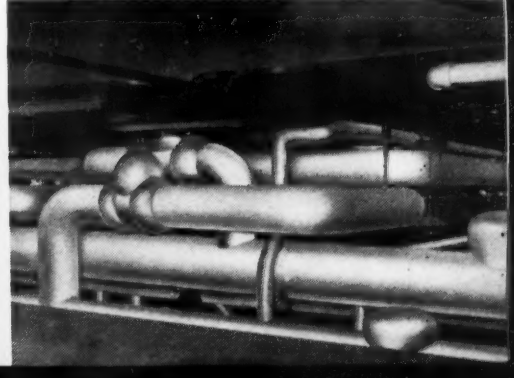
(*Below*) Medium and High Pressure Steam Surfaces (200°F to 500°F) Carey 85% Magnesia; Multi-Ply or Asbestos Sponge

Cold Water Pipes Carey Impervo; Perfecto; Protecto



Low and Medium Pressure Steam Surfaces (100°F to 300°F) Careycel; Air Cell; Excel





SMALL SCRAPER STORES AND RECLAIMS 3,500 TONS PER MONTH

Here is a ¾ cu. yd. Sauerman unit installed on a strip of ground alongside an unloading trestle. It handles all the coal burned by an industrial plant—averaging 120 tons per day.

6 CU. YD. SAUERMAN SCRAPER TAKES CARE OF 100,000-TON STOCKPILE

This picture shows storage system with 450-ft. operating radius that stores and reclaims 200 t.p.h. at large generating station. Coal is piled 30 ft. high and nearly 200,000 tons can be stored on the 450' x 900' space.

**BETTER and CHEAPER Coal Storage Method**

Any plant that lacks facilities for stockpiling coal can remedy matters quickly by installing a SAUERMAN Power Scraper. The advantages of this equipment are:

ECONOMY—Capital cost is low. Machine is operated by one man. About ¼ kwh. of power is consumed for every ton of coal moved 100 ft. Maintenance averages about ½¢ per ton stored or reclaimed.

FLEXIBILITY—No matter what the shape of an area, the scraper makes complete use of the space. Coal is reclaimed from any point in the pile just as easily as it is stored.

MINIMUM FIRE HAZARD—Scraper layers the coal into the pile, so that there are no air pockets to create hot spots.

A catalog giving details on equipment layouts for coal storage projects of every size, will be mailed gladly on request.

**SAUERMAN BROS., INC. 562 S. Clinton St. CHICAGO ILLINOIS**

**CONTROL EQUIPMENT by**

**★K&M CONTROL ENGINEERS since 1879**

**REDUCING VALVES**

Kieley & Mueller Reducing Valves — the products of more than 63 years specialized experience in the design and manufacture of steam specialties — include types for all services as follows: (a) ordinary reduction with comparatively constant inlet pressure and continuous flow; (b) ordinary reduction with comparatively constant inlet pressure but for dead end service; (c) pulsating inlet pressure or highly varying loads maintaining constant reduced pressure; (d) high pressure drop.

Shown here are two widely used types.

**SPRING LOADED REDUCING VALVE**

Suitable for steam or gas; for initial pressure to 400 lb.; made in cast steel for high pressures. Sizes: ½" to 12". Recommended for use as primary valve in double reduction installations for heating systems or for steam or gas reduction service in industrial process.

We're "ALL OUT" so the AXIS will be "ALL IN" Please bear with us for the duration —

**INTERNAL PILOT REGULATING AND REDUCING VALVE**

Designed for steam, oil and water; built for initial pressures of 300 lb. or less and for reduced pressure ranges of from one lb. to 75% of the initial pressure; excellent for pulsating inlet pressures and other difficult conditions. Dead end single seat shut off. Sizes: ½" to 10".

KIELEY SINCE 1879 MUELLER

**KIELEY & MUELLER**

*General Offices and Factory*

2013-2033 — 43rd Street, North Bergen, N. J.

Reducing Valves — Liquid Level Controls — Float Valves — Pump Governors — Strainers — Control Specialties.


doubled and full advantage made of the high-speed operation of induction heating.

The frequency at which the required current can be induced in the strip without using abnormally high voltages depends upon the thickness of the sheet. Since tinplate usually is of the order of 0.008 to .011 in., a frequency of approximately 200,000 cycles per second is most practical for this thickness of sheet. The inductor heater coil is rectangular in form, wound as close to the strip as mechanically possible. It acts as the primary of a transformer while the strip itself constitutes a single turn secondary. The induced current flows across the strip paralleling the turns of the inductor heater coil. The heat generated in the strip is caused by the resistance of the strip and the current flowing through it.

Power is supplied by vacuum tube oscillators, which are essentially the same as the transmitter of a radio station. Sixty-cycle alternating current is rectified to direct current and fed to the oscillator tubes where it is converted to 200,000 cycles per second and sent out through the inductor heater coil. One plant is installing tin flowing oscillator units with 72 times the power of the most powerful radio broadcasting station in the United States. In general the practical high-frequency limit for rotating machinery is of the order of 15,000 cycles per second—for applications requiring higher frequencies it is customary to use vacuum tube oscillators.

## Cincinnati Host to ASHVE Meeting

The 49th Annual Meeting of the American Society of Heating and Ventilating Engineers will provide a forum for the exchange of vital engineering information, according to the statement of Pres E O Eastwood, Seattle, who announced the time and place of the meeting—January 25-27, 1943, Hotel Gibson, Cincinnati, Ohio.

The Meetings Committee has prepared a streamlined program which includes subjects of wartime interest, such as fuel conservation, food dehydration, manpower problems, warship ventilation and physiological studies affecting efficiency and health.

Four technical sessions will be held, commencing on Monday morning, January 25, and there will be several research papers covering studies of heating plant operation with reduced night temperatures, resistance of various building materials to vapor transmis-

# *Conserve chemicals!*

## • • • SELECT A

# WORTHINGTON WATER SOFTENER

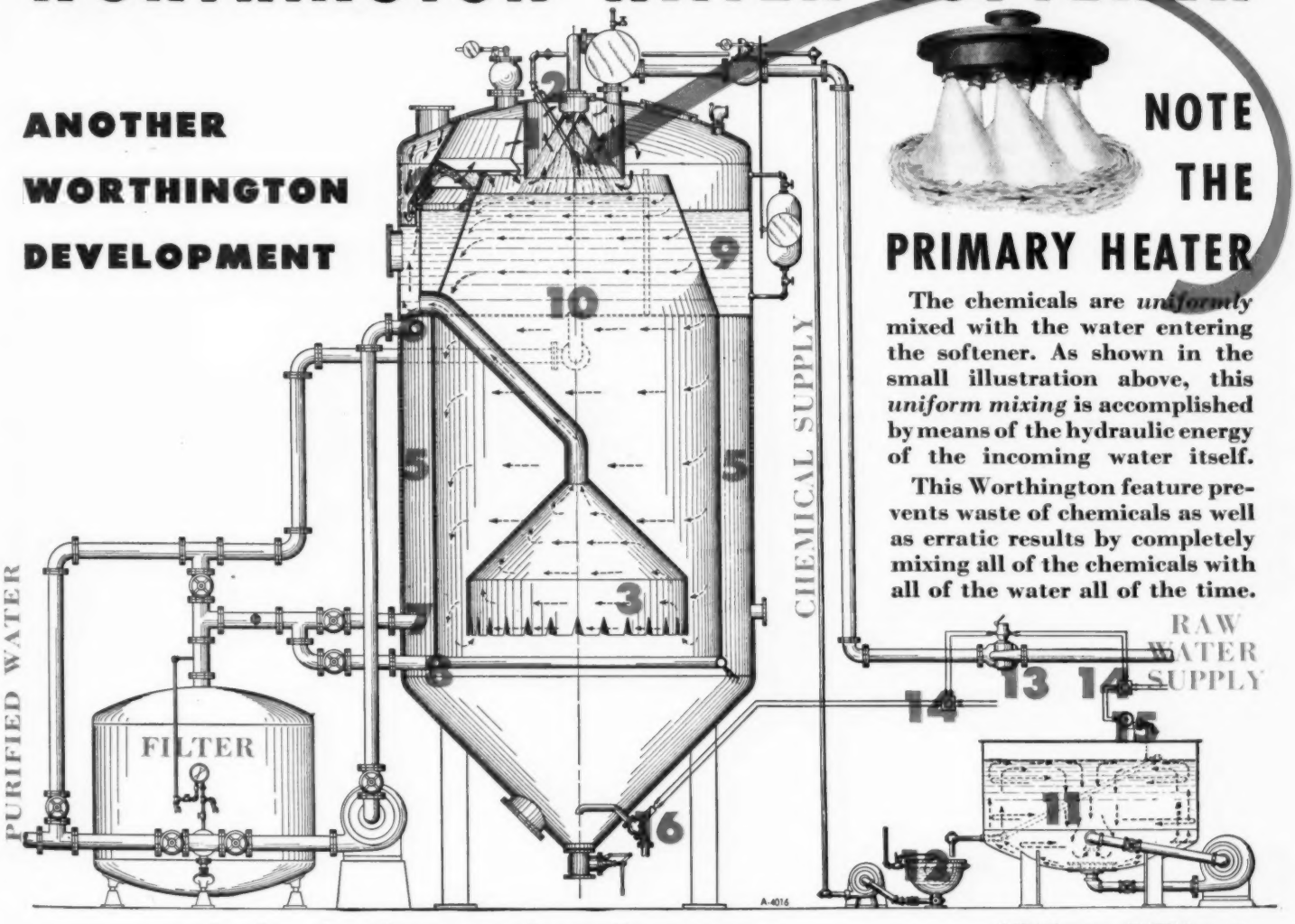
**ANOTHER WORTHINGTON DEVELOPMENT**



## NOTE THE PRIMARY HEATER

**The chemicals are *uniformly* mixed with the water entering the softener. As shown in the small illustration above, this *uniform mixing* is accomplished by means of the hydraulic energy of the incoming water itself.**

**This Worthington feature prevents waste of chemicals as well as erratic results by completely mixing all of the chemicals with all of the water all of the time.**




## . . . *and check these other features*

1. Primary Heater. (See above).
2. Chemical Applicator. Removable. Sprays chemical through steam. Facilitates mixing and reaction.
3. Up-take Cone. Baffled serrations assure even draught. Increases softener capacity.
4. Deaerating Heater. Simple. Effective. Self-adjusting. No moving parts.
5. Wash Water Compartment. Backwashing operation separate from softening process. Disturbance of softening process by filter washing operation is avoided, permitting *uniformly* continuous operation.
6. Supply to Filter Wash Pump Suction.
7. Discharge of Dirt Laden Wash Water. Reclaimed by settling clear within 1½ hours.
8. Cleansing Ring. Provides uniform distribution of jets for washing softener precipitate and wash water sediment to central area of conical bottom.
9. Storage for Treated and Deaerated Water.
10. Treated and Deaerated Water Outlet to filters or direct to boiler feed pumps.
11. Chemical Agitator. Maintains chemical mixture of uniform strength. No submerged bearings or paddles. No objectionable surface wave action to interfere with decantation.
12. Chemical Dilution and Pump Suction Tank.
13. Proportioning Meter. Accurate. Low loss. Equipped with totalizing register.
14. Relays. Adjustable time interval.
15. Decanting Mechanism. Sturdy. Reliable. Accurate.
16. Sludge Remover. Removes sludge in proportion to its rate of formation.

***For full details Bulletin W-212-B2 is available at district offices (in all principal cities) or at headquarters.***

WS2-2

**WORTHINGTON**

WORTHINGTON PUMP & MACHINERY CORPORATION • GENERAL OFFICES: HARRISON, N. J.

# PATCH FLOORS

## . . . While Traffic Rolls

Roll a drum of INSTANT-USE over to the hole in the floor—remove the lid—shovel out enough to fill the hole—tamp smooth—and open the spot to regular traffic immediately, without waiting. You'll have a tough, solid, permanent patch that formerly took 24 hours to get. This rugged, new plastic bonds tight to old concrete, withstands extreme loads. Keep a drum on hand. Immediate shipment.

REQUEST DESCRIPTIVE FOLDER

. . . and Details of

FREE TRIAL OFFER

**INSTANT-USE**

FLEXROCK CO., 2377 Manning St., Phila., Pa.



## PAPER MILL says ADAMANT FIRE BRICK CEMENT IS BEST MATERIAL THEY HAVE USED

Here's what they say: "Our experience with this cement has been very satisfactory; in fact, it is the best material of this nature that we have as yet used in our boiler room." ADAMANT is the sure means to get longer life from your furnace-linings—with fewer shutdowns for relining. Impartial laboratory tests prove that ADAMANT has a bonding strength of 800 lbs. per sq. in. at room temperature; 1270 lbs. per sq. in. at 2600°F. Let us send you the complete facts about ADAMANT—write us today.

ADAMANT has a P.C.E. of over 3000°F.

**BOTFIELD**
REFRACTORIES COMPANY

784 S. Swanson St., Philadelphia, Pa.

In Canada, Canadian Botfield Refractories Co., Ltd., 171 Eastern Avenue, Toronto


sion, and performance of air duct outlets.

The members of the Cincinnati Chapter will be hosts for the occasion.

## Motor Maintenance

Electric motors are the muscles of industry and if they are regularly serviced they will give dependable, long-time service. But neglect leads to breakdowns—with consequent interruptions in production—and, perhaps, to fire.

The following ten commandments of motor maintenance should always be observed, but, at the same time, shops where motors are used should always be protected with suitable types of approved fire extinguishers. Vaporizing liquid and carbon dioxide are suitable for this purpose since their contents are non-conducting and will not cause corrosion or otherwise damage motors.

1. Open-type motors should be blown out weekly; those operating under severe conditions, daily. Use no more than fifty pounds of pressure to avoid possible damage to insulation.
2. Follow manufacturer's instructions in lubricating motors. Too much oil is as bad as too little, causing deterioration of insulation.
3. Inspect bearings weekly or oftener. Feel temperatures, examine for excessive end play, and make certain oil rings are working.
4. Inspect brushes and commutators weekly or oftener. Make certain brushes are seated perfectly and commutators are smooth. Use proper grade of carbon brushes to prevent wear of commutator and reduce sparking.
5. Where motors operate with excessive belt tension, check the air gap between rotor and stator every week. A monthly check of motors in average use is sufficient. Difference in the width of the gap around the circumference of the rotor will indicate extent of wear on bearings.
6. Where motor leads are exposed to view, check them weekly to see that connections are tight, well insulated and protected, and free from oil.
7. Inspect ground connections weekly, keeping them tight and in good condition. This is for the protection of employees, and for the proper operation of overcurrent protective devices.
8. Set up a regular schedule for overhauling motors. Most motors

A De Laval-IMO Rotary Displacement OIL PUMP with steam-turbine drive is always ready and will run as long as there is steam pressure. The unit shown is for fuel oil booster service. It includes a worm gear speed reduction and is arranged to be mounted on a bulkhead. The turbine and gear are designed for continuous, reliable operation, having a lube oil circulating pump, combined oil cooler and filter and sight flow indicator, as well as mechanical governor and steam pressure release valve on the turbine casing. IMO delivers any oil in any volume against any pressure.

*Ask for Publication 1-101*

**IMO PUMP DIVISION**
of the De Laval Steam Turbine Company
Trenton, New Jersey



## HERCULES
*Seamless Copper*
## FLOATS

## GUARANTEED TO STAND UP!

Every Hercules Float carries our guarantee to stand up under 350 lbs. working pressure and 500 degrees temperature.

Fabricated of seamless copper under our special spinning process. Hercules Floats are uniform in thickness and high in mechanical strength.

You can depend on Hercules for floats—in standard shapes up to 10 in. and in special types to your specifications—to give long, dependable, economical service.

Insure care-free maintenance of water level in your heaters, tanks, reservoirs and other equipment by specifying "HERCULES."

**HERCULES FLOAT WORKS**
200 Franklin St.
SPRINGFIELD, MASS.

# An announcement

*concerning*

# replacement parts for DE LA VERGNE DIESEL ENGINES

America's war production has created unprecedented demands for De La Vergne Diesel Engines. Our shops are working 24 hours a day, producing De La Vergnes to aid our armed forces to bring Victory at the earliest possible moment. Naturally, *new* diesel engines must come first. But in spite of this, we are doing everything in our power to produce replacement parts despite the difficulty in securing critical and other materials.

You can aid the war effort, yourself, other owners and us here at Baldwin by ordering *only those replacement parts you need* to keep your De La Vergne in operation. We will do our best to get you what you need, as quickly as we are permitted to make and ship parts.

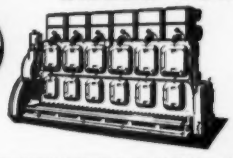
Your cooperation and patience will be sincerely appreciated, by us, our many customers and those units of the armed service which are using De La Vergne to speed Victory. Baldwin De La Vergne Sales Corp., a subsidiary of The Baldwin Locomotive Works, Philadelphia, Pa.

**BALDWIN**

*De La Vergne*

**SALES CORP.**

BLW THE BALDWIN GROUP



SUBSIDIARY OF THE BALDWIN LOCOMOTIVE WORKS • PHILADELPHIA

THANKS FOR THE TIP...WE'LL USE PALMETTO PACKING

Ask any user why he prefers Palmetto Packing.

He'll say something like this: "I've tried a lot of packings and I find Palmetto lasts longer, stays soft and never scores a shaft."

Yes, ask a user . . . or better yet try Palmetto yourself.

WRITE FOR LITERATURE

GREENE, TWEED & COMPANY

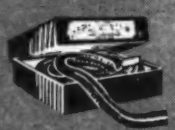
Bronx Blvd. at 238th St., New York, N. Y.

TWISTED

For valve stems; each strand a perfect plate of lubricated packing.

BRAIDED

For rods and shafts; layer over layer construction insures uniformly even bearing surfaces.



PALMETTO

for steam, hot water, air. PALCO for water. PELRO for oils. CUTNO for alkalis. SUPERCUTNO (blue asbestos) for acids. KLERO for foods.

SELF-LUBRICATING PACKINGS


should be overhauled annually, while those in severe use should be overhauled twice a year or oftener.

9. Dismantle the motor for a complete overhaul job. Wash all parts with carbon tetrachloride or some other safety solvent. Paint the windings with a good, oil-resisting insulating varnish.
10. Keep the area around the motor as clean as the motor. Arcing frequently ignites oily material that has not been cleaned up.

When fire breaks out in or around a motor, shut off the power before attacking the flames, if possible. Do not depend upon the circuit breaker operating or a fuse blowing out, but shut off the power. This will minimize damage to the motor and prevent continued arcing from re-igniting the fire. When the motor or conductors are dead, direct the fire extinguishing agent into the motor or upon whatever is burning, just as in any other fire. As soon as the fire is out, ventilate the area thoroughly to clear out smoke and fire gases.

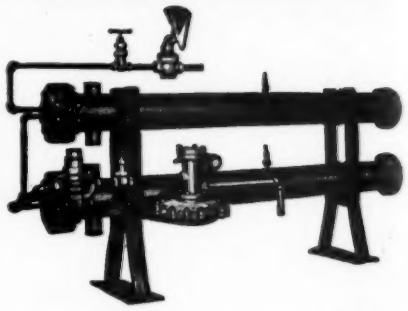
## Battelle Undertakes Largest Coal Project

Bituminous Coal Research, Inc, the research agency of the National Coal Association and the bituminous coal industry, has completed contract arrangements with Battelle Memorial Institute, Columbus, Ohio, for the largest coal research program ever undertaken by the coal industry, Clyde E Williams, Battelle director disclosed recently.

The contract, 50% larger than any research contract heretofore placed by the coal industry, calls for emphasis on the power and fuel problems of war industries and for the expansion and extension of earlier research studies. There will be extended investigations in the application of coal to metallurgical processes and of means of conserving coal by more efficient utilization in industrial and domestic power and heating plants.

In addition to conducting the research program, Bituminous Coal Research, and its technical committee of fuel engineers, is serving as consultant to the government's Solid Fuel Coordinator, Petroleum Coordinator, and the Power Branch of the War Production Board. Its services are being utilized for advisory work relating to the conversion of steam plants from other fuels to coal, as well as to assist in the selection of the available coal and proper burning equipment for new plants


HENSZEY



CONTINUOUS BLOWDOWN

The Henszey system continuously and automatically draws off the trouble-making impurities of the boiler water —keeping them well below a predetermined "safe point". Priming, foaming, carryover and (with simple chemical treatment) scale are prevented. This system in operation enables your boilers to produce at maximum capacity for longer periods between shutdowns —enables you to produce the great volume of clean steam needed for war production.

*Send for descriptive bulletin.*

HENSZEY COMPANY

Dept. D1 Watertown, Wis.

One Formula for All These Uses

X-Pando Pipe Joint Compound is the *standard* compound in American industrial, chemical, refrigerating and power plants because it's more economical, more efficient, more versatile. You can't pick up the wrong can when you use X-Pando because the *one* formula holds anything carried in metal pipe except certain heavy acids. Here are a few X-Pando uses.

| | |
|---|---|
| Ammonia Lines | Pumps |
| Diesel Engines | Purifiers |
| Oil Burners | CO2 Lines |
| Freon Lines | Gasoline Lines |
| Refrigerant Lines | Condensers |
| Fuel Lines | Steam Lines |
| All Cargo Lines | Hot Water and all other lines |

X-PANDO PIPE JOINT COMPOUND

Expands as it sets — ends leaks permanently. Corrects imperfections in threads. Smooths flanged faces. Expands and contracts with pipe movement. Not affected by vibration, high temperature, deflection, or pressures.

DISTRIBUTORS EVERYWHERE

Get X-PANDO from your local Mill Supply House.

X-PANDO CORPORATION

43-15-36th Street, Long Island City, N. Y.
Stillwell 4-7180

Canadian Distributors: La Salle Products Ltd., 159 Jean Talon St., Montreal, Quebec, Canada

# Announcing a New Name

## in the Steel Tube Industry

# Electroweld STEEL CORPORATION

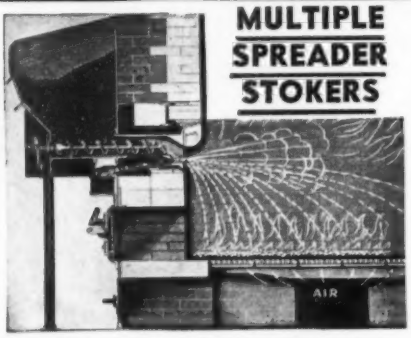
● You will want to remember the name ELECTRO-WELD. It is stenciled on every length of the world's most modern steel tubing.

The Electroweld Steel Corporation recently completed America's most up-to-date, continuous, electric resistance welded tube mill for the production of pressure tubing and mechanical tubing. The refinements incorporated in this mill provide an improved product with a silver-bright surface. Precision control over the entire production operation lends uniformity of structure in the weld area, and thus ELECTROWELD Steel Tubing has a homogeneous structure throughout. This new mill not only forms tubing more accurately to size than commercial tolerance requirements, but it also permits greater uniformity of wall thickness, weight, and ductility. Furthermore, no other steel tubing is cut off so smoothly.

Electroweld Tubing goes to war in an amazing quantity. Another mill, now being built, will increase Electroweld production. When victory be ours, we trust that our type of products will fit into your peacetime operations.

**Electroweld STEEL CORPORATION · OIL CITY · PENNA.**

# FYR-FEEDER




MULTIPLE SPREADER STOKERS

## BURN COAL LIKE OIL!

American Coal Burner Company
15 East Erie St., Chicago, Ill.

Gentlemen:-

I wish to take this opportunity of congratulating you upon the excellent stoker which you have furnished us. We have used your stoker continually for about six weeks, namely, during the time we were putting up our pea pack. This is the time of the year when the greatest stress is put upon men and machinery and I must say that your stoker came through with flying colors.

Never before have we had such even steam pressure and such a maximum amount of driving power. Your FYR-FEEDER burns up the coal most uniformaly, thereby getting the utmost heat out of the fuel, and leaving very little waste.

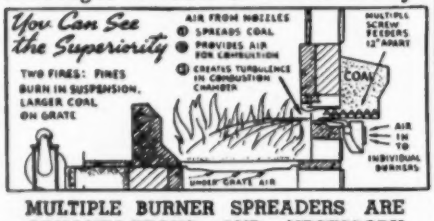
Needless to say, this has resulted in a saving for us both in labor and fuel, and at the same time increasing the output which we were so much in need of. I would not hesitate to recommend this stoker to my best friend.

Sincerely yours,
(Large Packing Plant)

Name on request

## QUICK DELIVERIES
**for all industrial applications**

ACT now to protect yourself against *FUEL SHORTAGE, steam shortage and manpower shortage.* WRITE or WIRE today.


You Can See the Superiority
TWO FIRES: FINES BURN IN SUSPENSION, LARGER COAL ON GRATE
AIR FROM NOZZLES
① SPREADS COAL
② PROVIDES AIR FOR COMBUSTION
③ CREATES TURBULENCE IN COMBUSTION CHAMBER
MULTIPLE SCREW FEEDERS 12" APART
COAL
AIR IN TO INDIVIDUAL BURNERS
UNDER GRATE AIR

MULTIPLE BURNER SPREADERS ARE ADVANTAGEOUS AND NECESSARY
Each FYR-FEEDER has 2, or 4, or more burner spreaders giving dependability and convenience in cleaning grates, impossible to secure with a single spreader.

**AMERICAN**
**COAL BURNER CO.**
***ENGINEERS, Est. 1918***
**32-18 East Erie St., Chicago, Ill.**


which will be built by the government or by industries under War Production Board permission.

Further development of the use of pulverized coal in forge furnaces is scheduled in the new research program. Such a development will effect great savings of oil and gas in war industries, as will the successful conclusion of another research investigation—the application of pulverized coal to radiant tube and other industrial furnaces.

There are several processes in which coal is currently used in the manufacture of gas, but such gas is more costly than natural gas and its industrial uses are limited. Gasification of coal—its complete conversion into fuel gas by chemical and physical means—will be investigated by Battelle fuel technologists in an effort to arrive at a more economical gaseous fuel.

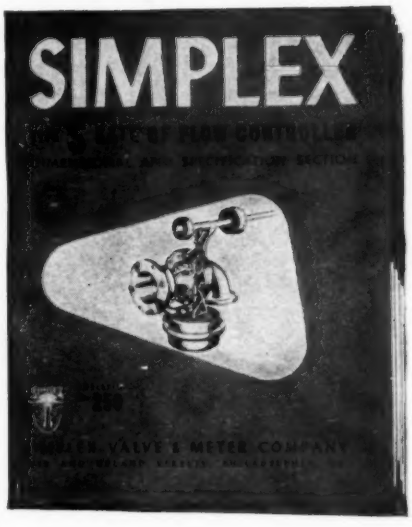
Smokeless methods of coal combustion, in which the smoke that ordinarily goes up the flue of the factory or home is burned to colorless gases, will also be studied under the new program. Battelle fuel engineers have already developed a smokeless stove for the home, and will now seek to extend its principle to other heating equipment. Smokeless combustion releases practically all of the heat energy of coal, thus salvaging great quantities of energy which is usually allowed to go to waste as smoke.

Other research studies will include the necessary development of chemical dust-proofing of coal to replace the present oil-treatment methods, the development of power directly from coal by the use of pulverized coal as a fuel in an internal combustion engine, and an investigation of possible new designs in coal-burning railroad locomotives.

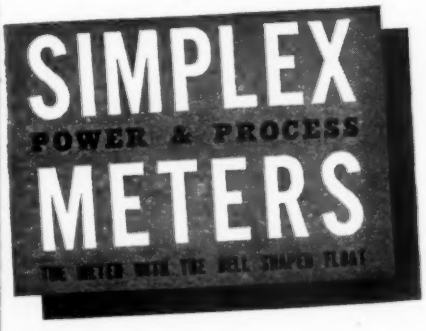
The research program at Battelle Memorial Institute is under the direct supervision of Ralph A Sherman, well-known fuels authority of the Institute's staff, who has available the services and facilities of one of the country's largest research organizations.

The program is financed jointly by coal producers' associations, leading coal carrying railroads, and individual coal companies throughout the country. The present program is a continuation of previous research by Bituminous Coal Research, the major part of which was likewise conducted at Battelle. In the earlier program, research on the problem of selection and preparation of coal for residential underfeed stokers, on the dust-proofing of coal with oil, on the relative economies of house heating with various fuels, on the segre-


# In response to demands for plain facts . . .




Simplex Bulletin 250 puts at your finger tips detailed dimensional data necessary for design and specification purposes.




**Simplex Valve & Meter Co.**
6780 Upland St. Philadelphia, Pa.

# Call Clarage!

## for EXPERT HELP on any WAR-TIME AIR-HANDLING PROBLEM

To give ***immediate assistance*** to our Government— and to industry engaged in vital war-time production — Clarage maintains application engineering offices at all the strategic points indicated on the map above.

Each Clarage branch office is ***manned by experts*** — by capable engineers long experienced in successfully meeting air-handling requirements of every conceivable kind.

On hundreds of America's fighting and cargo ships, in Army tanks, and in war plants from coast to coast — wherever DEPENDABLE ventilation, cooling, mechanical draft, etc., are essential — ***there fans, blowers and allied equipment built by Clarage play their part.***

***We're on our toes to help you!*** We're trying hard to maintain a prompt, intelligent, satisfactory war-time service — all the way from initial recommendation to delivery.

It will pay you to dial our number in your city, or phone or write the factory at Kalamazoo.

**COMPLETE AIR CONDITIONING**
•
**COOLING**
•
**VENTILATION**
•
**FACTORY HEATING**
•
**MECHANICAL DRAFT**
•
**FANS and BLOWERS for INDUSTRIAL NEEDS**

**Clarage Fan Company** Kalamazoo, Mich.

APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

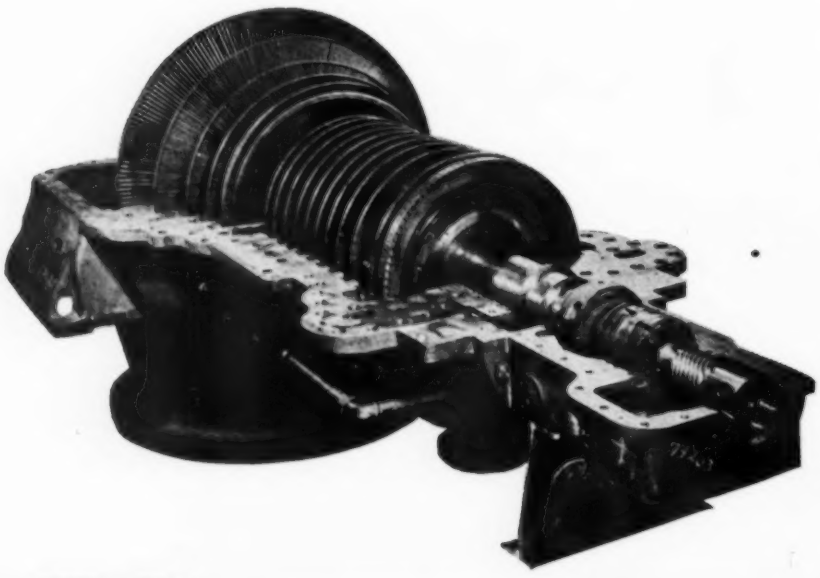
# MURRAY TURBINES

***Lubrication precautions are few and simple but extremely important for longer life and better performance of your MURRAY UNITS***

● **CLEANLINESS:** It is essential to guard against impurities gaining entrance and contaminating the oil. **OIL TEMPERATURE:** As oil temperature rises, the tendency of the oil to oxidize and deteriorate is accelerated—we suggest that a careful check by kept on your oil temperature. **OIL PRESSURE:** The oil pressure provides an index to the proper operation of the system as a whole—all pressure changes, sudden or gradual, should be investigated. **OIL LEVEL:** To neglect the oil level in bearings or supply tanks is to jeopardize all other good work done toward maintaining correct lubrication. **FOAMING:** Breakdown of generator insulation, short circuits, etc. result through escaping oil due to foaming. On some installations it has been found that a slight reduction in the pressure at which oil is circulated will be beneficial—on others the correction has been accomplished by reducing the flow of water through the cooler and circulating the oil at a slightly higher temperature. Lack of oil is a likely cause of foaming. Adding too much new oil to the system at one time is another cause. **SLUDGE:** Possibility of this formation is minimized by using a high grade oil and keeping system free from impurities. **DRAINING:** Regular draining and renewal of the lubricating charge is essential to continued efficiency in lubrication.

This organization has occupied a prominent place in the steam power equipment field for nearly three quarters of a century. Thousands of Murray Turbines, engines, and boilers serving throughout the world reflect the skill that goes into them.

Our Bulletin T-120 gives you details on all these points and makes other valuable suggestions.



BOILERS · ENGINES · TURBINES

MURRAY
IRON WORKS COMPANY
INCORPORATED 1870
BURLINGTON IOWA


gation of coal in industrial powerplant bunkers, on the utilization of coal in pulverized form in steam plants, on the use of coal for the dehydration of hay, and on the possibilities of research in the gasification of coal developed information that has materially aided the bituminous coal and allied industries.

## Attention Purchasers of Electric Motors

A purchaser of an electric motor must show that the horse power of the motor he is applying for is no greater than that required to do the job, according to a provision in General Conservation Order L-221, announced today by the Director General for Operations.

Officials of the General Industrial Equipment Division pointed out that it has been the practice of industry for many years to "over-motor," that is, to apply greater motor capacity than necessary for the job to be done. As a means of stopping this practice, the order applies certain measurements by which the actual power requirements may be related to the horse power of the motor applied for the purchaser.

L-221 prohibits the delivery or acceptance of motors, unless they comply with certain standard specifications and are of the simplest practicable, mechanical and electrical design. It also requires the purchaser to certify and show reason why he must have a motor of a special type; and it restricts the use of such special types to the conditions and the purposes for which they are required. For example, it limits the use of explosive proof motors to hazardous locations.

One of the important conservation provisions in the order applies to both motors and generators. It requires the applicant to certify that he has made every reasonable effort (1) to adapt idle motors or generators in his possession, (2) to obtain used ones for his purpose, and (3) to repair or recondition his existing equipment.

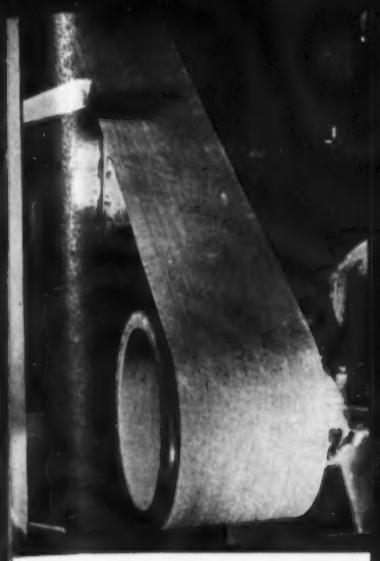
Where used equipment cannot be secured within a reasonable time by the applicant, it is suggested that he make his needs known to WPB's Surplus Used Equipment Branch, which will assist him in meeting them.

It is estimated that the conservation and simplification provisions in the order will save in one year about 15,000,000 pounds of copper, 55,000 tons of carbon steel and 150,000 pounds of stainless steel.

The order became effective December 10, 1942.

# ★ WAR on *Wear!* ★

## MANHATTAN'S suggestions for the Care of POWER TRANSMISSION BELTS



*How NOT to do it! Don't nail up a board to keep belt on pulleys. Align pulleys correctly and keep them clean.*

THE greater the output, speed and strain, the greater the belt wear. "Keep 'em running" on the factory front—with less wear and trouble—by following these simple instructions.

1. Do not allow oil, grease or gasoline to come in contact with belt.
2. Avoid exposing belts to sunlight and excessively hot or cold weather.
3. Avoid heavy overloads.
4. Don't leave tools or other objects near belt to get caught in drive.
5. Don't allow belt to rub against stationary objects. (See inset photograph.)
6. Use right size and type of belt on pulleys of correct size—too small pulleys shorten belt life.
7. Do not try to take out all stretch on new belt. Install only tight enough to pull load without slipping—then shorten only if necessary.
8. Use proper type fasteners of correct size for pulleys.
9. Keep tight side down for greater arc of contact and more power.
10. Pulleys with excessive crown cause fastener failure.
11. Do not apply large belts by rope and power.
12. Use constant tension motor base on short center drives.
13. Cut belt square and line up before splicing. Seam side away from pulleys.
14. Keep pulleys clean, in good condition and in correct alignment so that belts will run true and wear evenly.
15. Keep proper tension. Too tight a belt may cause fastener and bearing trouble; too loose, slip and wear.
16. If dressing is necessary, use type recommended by belt manufacturer. Never use rosin. Correct fault in drive instead of dressing belt.
17. Provide take-up facilities.
18. Inspect splices and remove worn fasteners before they cause injury to belt.
19. Avoid slippage, evidenced by polished surface.
20. Use factory-made endless belts whenever possible.
21. Cut down large worn belts into smaller sizes for light drives.
22. Consult your MANHATTAN representative. Write factory or your distributor.

Inspect daily with special reference to above suggestions. It is constant care that reduces wear and keeps your belts turning your machines with the minimum of stoppage.

*Note how belt hugs clean, correctly aligned pulleys. Belt runs true and is in excellent condition after three years because of daily checking and cleaning.*

***"Care of Power Transmission Belts" wall cards available for your maintenance department — also for Hose, V-Belts and Conveyor Belts. Write for those you want.***

**KEEP AHEAD WITH**

**MANHATTAN**

**THROW YOUR SCRAP INTO THE FIGHT!**

**THE MANHATTAN RUBBER MANUFACTURING DIVISION**
of RAYBESTOS-MANHATTAN, INC.
EXECUTIVE OFFICES PASSAIC, NEW JERSEY

***Ruggedness and dependable Accuracy, too, distinguish the ALL-METAL THERMOMETER***

Readability in an indicating thermometer is an outstanding advantage *if* full dependence can be placed on each reading. The WESTON thermometer provides both these essential factors . . . readability and dependability . . . without compromise. It's simple, all-metal temperature principle . . . minus gases, liquids, capillary and involved mechanisms . . . assures "on-the-dot" accuracy over a far longer period of time. In addition, this all-metal construction safeguards against failures due to vibration or over-ranging. » » » Literature gladly sent on request, although production facilities are at present devoted solely to the war effort. Weston Electrical Instrument Corporation, 679 Frelinghuysen Avenue, Newark, New Jersey.

**WESTON** ***ALL-METAL*** **TEMPERATURE GAUGES**

**ROCKWELL**
**BLAST GATES**

**COST LESS**

*. . . to install*

*. . . to operate*

*. . . to maintain*

. . . because they combine compactness with efficiency, lightness with strength, simplicity with durability. These accurately built units are air-tight, readily adjusted, and thoroughly dependable. Furnished in a range of types, sizes, and methods of control for any low-pressure air requirements. Write for Bulletin 4020.

Flanged Slide Type of Rockwell Blast Gates

**W. S. ROCKWELL COMPANY**
Blast Gate Division
10 CHURCH STREET NEW YORK, N. Y.

**Make Your Overhead Valves SAFE And Easy to Reach---**

With the Babbitt Rim for Valves you eliminate danger and banish the step ladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

**BABBITT STEAM SPECIALTY CO.**
New Bedford, Mass.


## Modern Steam Generation

E G Bailey, vice president of the Babcock & Wilcox Co and recent recipient of the Percy Nicholls and ASME Medals, presented the story of "Modern Steam Generation" to a group of 178 Northern Indiana engineers Tuesday, December 15th, at South Bend. The meeting was sponsored jointly by the Engineers' and Architects' Club, The St. Joseph Valley Section of the ASME and the Indiana Power Engineers, Inc.

To show the advances made during the last twenty years in boiler design, Mr. Bailey used a color film of the old 650-psi and the new 2500-psi boilers at the Twin Branch Plant of the Indiana & Michigan Electric Company at Mishawaka, Indiana. To make the slow motion color film easier to follow, a color slide of the boiler being shown on the screen was kept on an additional screen provided for that purpose. This film, particularly that portion dealing with the primary furnace of the 2500-psi boiler, represents a great deal of original work on the part of Mr. Bailey, as clear pictures of temperatures of 3300 F were shown.

The advances made in the last few years in metallurgy and feed-water chemistry provide the boiler designer with the requisite tools to build boilers for the modern high pressures and temperatures. Paying tribute to the operating engineers, Mr Bailey stated that none of the excellent records now being made would have been possible except for their whole-hearted cooperation.

Designs for providing 1400-F superheated steam for the Houdry process to extract Butadiene were shown as well as methods for accurately controlling this superheat temperature. In commenting on the forced-circulation boilers, Mr Bailey stated that they have their place and should prove excellent for applications such as locomotives and ships, etc. where space and weight are at a premium.

## USES Lists Occupations Suitable for Women

United States Employment Service has listed 60 occupations in the electric utility industry for which women are suitable workers, even though they are not normally employed therein. The bulletin is part of USES campaign to augment draft-riddled labor forces.

Classifications approved for women range from simple to highly specialized. Simple occupations include watchman, porter, chauffeur and clerk. Specialized

# Softening Boiler Feedwater

**at high temperatures was introduced commercially by COCHRANE**

**From Laboratory Analysis to the Production of the Equipment . . .**

**COCHRANE all the way**

PRIOR to the introduction of Cochrane Hot Process Water Softeners in 1900, the conditioning of feedwater was confined to cold processes of the continuous or intermittent batch type. Since that time, Cochrane has continuously developed the process and the equipment until at the present time this apparatus is successfully treating water for boilers operating at pressures as high as 1400 lbs. per square inch.

All of the developments listed at right were pioneered by Cochrane, culminating in the present-day apparatus, the most versatile method of water treatment for boiler feed purposes. It is pioneering that has maintained this leadership since Cochrane introduced the original Hot Process Water Softener in 1900.

**COCHRANE CORPORATION**
**3106 N. 17th Street, Philadelphia, Pa.**

**COCHRANE**

SOFTENERS · DEAERATING SOFTENERS · DEAERATORS · METERS · STEAM SPECIALTIES

Some of the outstanding Cochrane developments in water conditioning are as follows:

1. The use of non-silicious filtering material.
2. Back-washing filters with water from the sedimentation tank.
3. Application of jet heaters in place of tray heaters.
4. Supplementary treatment of phosphate as an adjunct to external treatment.
5. Treatment by phosphate in single- or two-stage apparatus.
6. Deaeration by atomization, eliminating entirely the use of trays.
7. Use of magnesium sulphate and other magnesium salts for reduction of silica.
8. Use of phosphoric acid as a treating agent in single- or two-stage water softeners, producing controlled alkalinity and zero hardness.

# DON'T OVERLOAD!

**WRIGHT HOISTS** are built to carry more than their rated capacities, but like other well-made pieces of mechanical equipment they should not be overloaded. Overloading is dangerous—while today, abuse to machinery is akin to sabotage.

**Watch the bottom hook.** **WRIGHT** load hooks are drop-forged from special steel which, when subjected to excessive overloading, give visible warning by opening slowly. When the bottom hook has started to open, look to the top hook, too, for while it is stronger than the bottom hook, it also may be reaching a danger point.

**Watch the load chain.** **WRIGHT HOIST** load chains are electrically welded from special-analysis steel, exceptionally high in tensile strength and elastic limit. Excessive overloading will stretch the chains out of pitch, thus preventing proper fit with load wheel pockets. This results in destructive wear to both chain and load wheel. Keep your chains well-lubricated for long life. Take proper care of your **WRIGHT HOISTS.** You'll find the name of your nearest **WRIGHT** distributor in the telephone book.

*In Business for Your Safety*

**WRIGHT MANUFACTURING DIVISION**
York Pa., Chicago, San Francisco, New York

**AMERICAN CHAIN & CABLE COMPANY, Inc.**
BRIDGEPORT, CONNECTICUT


occupations include cable puller a repairman, field-coil winder, powe house oiler, generator operator, electrical engineer, electrical tester and off manager.

The occupations are divided into four classes, including those with a normal training period of less than six months, those with training periods of two to six months, those with training periods of six months to a year and those requiring more than two years for training.

Some job titles included in the four classes established by USES follow:

Cable puller, cable repairman, electrician apprentice, electrician helper, field-coil winder, low-pressure fireman, material clerk, painter helper, lead painter, porter, solderer, warehouse record and stock clerk, watchman, and welder helper, all of which are listed as jobs requiring less than two months training.

Bench repairman, electrical engineer, electrical tester, chief electrician, electrician foreman, powerhouse electrician, wiring and wire running electrician, generator operator, office manager, personnel manager, specification writer, stationary engineer, substation operator, surveyor, switchboard operator and leader weldman are occupations requiring two or more years training.

## Belting Association Elects Officers

The American Leather Belting Association held its annual meeting in New York Friday, December 4. The officers elected at this meeting were: president, Roy C Moore, Charles A Schieren Co, New York, N. Y.; vice-president, George L Abbott, Graton Knight Co, Worcester, Mass.; treasurer, Arthur H Rahmann & Co, New York, N. Y. The new members elected to the board of directors were: C Carter Bond, Charles Bond Co, Philadelphia, Pa.; Roy C Moore, Charles A Schieren Co, New York, N. Y.; Frank F Raniville, F. Raniville Co, Grand Rapids, Mich. The members who remained on the board and who will carry through the year are: George L Abbott, Graton Knight Co. Worcester, Mass.; Edward H Ball, Chicago Belting Co, Chicago, Ill.; P H Slowey, Holyoke Belting Co, Holyoke, Mass.; Major A E Carpenter, E F Houghton & Co, Philadelphia, Pa.; and William T Bell, Page Belting Co, Concord, N. H. The headquarters office will be maintained at 53 Park Row, New York, N. Y.

# GET THE EQUIVALENT OF ADDED BOILER... Capacity

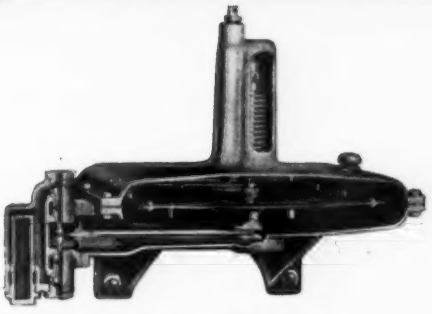
## CASH STANDARD AUTOMATIC COMBUSTION CONTROL SYSTEMS

★ Through the simple means of CASH STANDARD Automatic Combustion Control, the output of your present boiler can be boosted to give you more steam for increasing power and process needs. In accomplishing this you save fuel, for you cut wastage of coal, gas, or oil through correct fuel feed.

CASH STANDARD instruments maintain the proper proportion of air supply continuously so that you maintain effective combustion . . . where such controlled combustion exists there is no under-firing to cut steam supply nor over-firing to waste fuel. Through the proper operation of the stack damper, heat is not absorbed by excessive air above the fire and thereby lost through the stack . . . the heat goes direct to the boiler water to give you more steam.

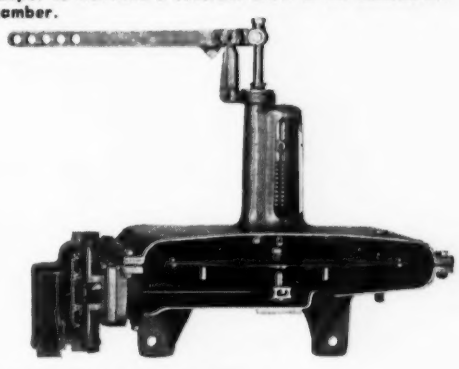
CASH STANDARD Automatic Combustion Control can be applied to all plants from the largest to those as small as 75 boiler horsepower. The units shown here make up a complete CASH STANDARD System and all boiler requirements can be supplied through availability of variations of these units.

Bulletin No. 300 gives the complete story on Automatic Combustion Control for steam plant economy.



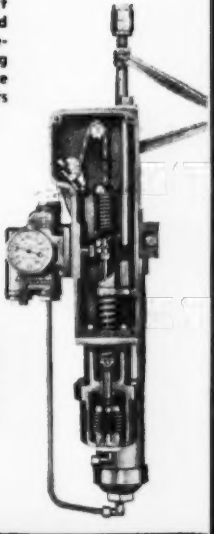
**FURNACE DRAFT CONTROLLER**

This CASH STANDARD Furnace Draft Controller (which comes complete with Operating Power Cylinder) works from overfire draft, regulating the boiler uptake damper to maintain a constant draft in the combustion chamber.



**AIR FLOW CONTROLLER**

This CASH STANDARD Air Flow Controller meters the air needed for combustion. Install it near its damper. It is not affected by changes in fuel bed resistance or any other variables, because it meters air supply according to the differential pressure through the gas passages of the boiler, doing its part to insure perfect combustion.



**FUEL FEED CONTROLLER**

This CASH STANDARD Master Controller automatically regulates fuel feed. Locate it conveniently. Working from boiler pressure, it will adjust the rate of combustion by regulating the rate at which fuel (any kind of fuel) is supplied to the boiler furnace. And it will adjust the Air Flow Controller so the correct amount of air is supplied for proper combustion — hence, money saving.

**A. W. CASH COMPANY**
DECATUR, ILLINOIS

**CASH STANDARD**
**CONTROLS . . VALVES**

## R/M NORTH CHARLESTON PLANT

## *AWARDED ARMY-NAVY "E"*

It is a tribute to American workers that more and more Army-Navy "E" burgees are being awarded. It shows the continuing upswing of America's production-curve as we enter our second year of the war. It promises an ever-increasing output that will crush our enemies by its very weight.

The North Charleston plant of Raybestos-Manhattan, Inc., is now privileged to fly this flag, "awarded for excellence in production." It is an award not lightly given, not easily held. It is an achievement and a challenge at one and the same time.

Raybestos-Manhattan accepts this Army-Navy "E" pennant in the name of its workers . . . the men and women who tirelessly turn out great quantities of R/M packings. It is to them, rather than to management, that we take off our hat and make a low, graceful bow. Nice going, North Charleston.

INDUSTRIAL SALES DIVISION
**RAYBESTOS-MANHATTAN, INC.**
MANHEIM, PA.
BRIDGEPORT, CONN. NORTH CHARLESTON, S. C. PASSAIC, N. J.
*Makers of Packings for Every Industrial Use*

## Cast Iron in High Temperature Operation

In accordance with the usual policy of relieving overburdened industries by encouraging the use of more readily available substitute materials whenever possible, the War Production Board has approved a field research project to study the possibility of utilizing cast iron in operations at elevated temperatures (in excess of 450 F). This program is being conducted by the War Metallurgy Committee, National Academy of Science, Washington, D. C., with the co-operation of the American Foundrymens Association. T E Barlow, Vanadium Corporation of America, and, C O Burgess, Union Carbide and Carbon Research Laboratories, have been appointed to obtain the desired data. Since time is vital in a project of this type these men have requested the co-operation of industry in locating specific applications in which cast iron is being or has been used, successfully or otherwise, at temperatures in excess of 450 F. The information obtained during this study will be reported statistically and the actual details of operation will be kept confidential when desired.

Engineers, foundrymen, field service men and others who have information on performance records of cast iron at elevated temperatures can make a valuable contribution to the ferrous industry and the war effort by contributing their knowledge and experience to this study. Detailed information or suggestions as to possible sources of such information, pertinent to the subject, should be sent to either T E Barlow, 2440 Book Bldg, Detroit, Mich., or C O Burgess, 4625 Royal Ave, Niagara Falls, N. Y.

## Utility Appointees

New chiefs of the Army and Navy Munitions Board's Power Section are Lt Col Allison R Williams and Lt Commander Maxwell Cole, both of whom have operating company backgrounds.

Lt Col Williams was a captain during the last war, after which he engaged in engineering practice in South Central states both as a consulting engineer and as general manager of a group of small Mississippi utilities. For some months before his recent assignment to active army duty, Williams served in the Power Requirements Section of WPB's Power Division.

Com Cole, a graduate of the Naval Academy in 1916, was retired in 1924, after which he served with the Philadelphia Electric Co. until his recall to active duty in 1941.

# The unequaled refining power of the Alchlor Process produces this unmatched turbine lubricant:

## GULFCREST OIL

This 10,000 kw unit is one of hundreds of turbines lubricated with Gulfcrest Oil.

THE performance of a turbine lubricant depends largely on how it is refined. That is why you insure better lubrication for your turbines when you use the only Alchlor-Processed turbine lubricant—Gulfcrest Oil.

For the Alchlor Process not only removes the general run of impurities present in all crude oils, but eliminates oxidation catalysts and rearranges the molecular structure of certain hydrocarbons. This unequaled refining power of the Alchlor Process produces a turbine oil with highest resistance to oxidation, highest resistance to acidity and sludge, and highest kilowatt-hour performance. Gulfcrest Oil is the world's finest oil for turbine lubrication!

Send the coupon below for the story of Gulfcrest Oil and what it can do for you — no obligation, of course.

*FOR VICTORY BUY UNITED STATES SAVINGS BONDS AND STAMPS*

GULF INDUSTRIAL LUBRICATION

Gulf Oil Corporation · Gulf Refining Company P
3800 Gulf Building, Pittsburgh, Pa.

Please send me my copy — no charge — of the brochure "Gulfcrest Turbine Oil."

Name.....

Company.....

Title.....

Address.....

# No Boiler Room is Immune

# YOURS TOO

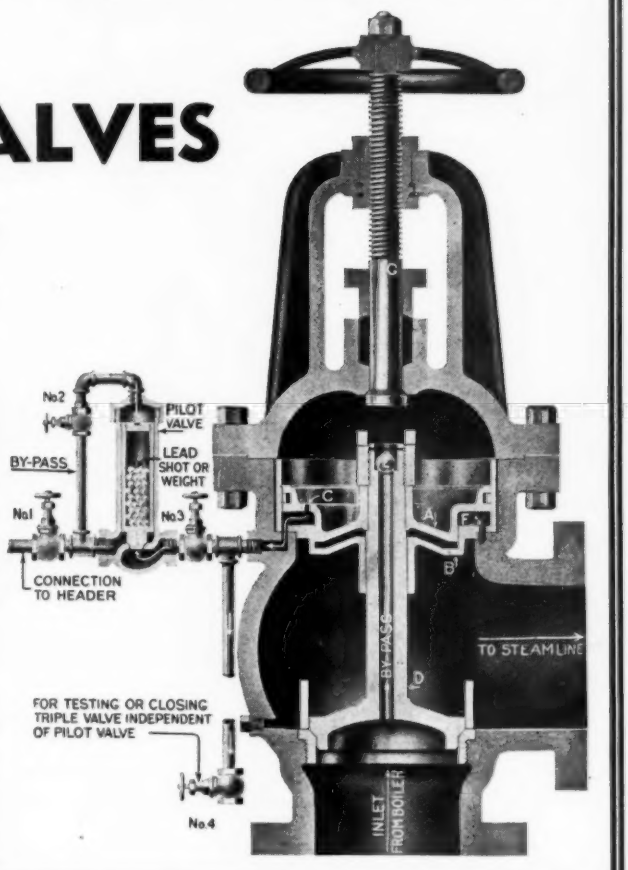
## SHOULD BE PROTECTED

*with*

# GOLDEN-ANDERSON

## Triple-Acting

# NON-RETURN VALVES




• Suppose a high pressure line breaks, inside the plant or an outside line? Suppose a tube blows in one boiler of a battery? In either case, the steam content of the whole battery will explode through that ruptured tube, unless you have the *automatic* protection of this valve.

Being triple-acting, it automatically cuts in a boiler whenever its pressure equals line-header pressure. It isolates a boiler automatically whenever its pressure, from any cause, is lower than line-header pressure. It prevents steam flow from boiler, in the event of sudden drop of line-header pressure below the boiler pressure.

*also* The G-A line includes Altitude Valves to prevent overflow of Standpipes, tanks, etc. — Emergency Stop Valves to prevent runaway turbines or engines — Steam and Water Pressure Reducing Valves, Check Valves, Float Valves, etc. Ask for new catalog, illustrating and describing full line.

**GOLDEN-ANDERSON VALVE SPECIALTY CO.**

**FULTON BLDG. • • • PITTSBURGH, PA.**

# WeldELLS *have everything* ★

## THOSE TANGENTS MEAN MORE THAN YOU MIGHT THINK

**For a pipe welding job to be right, two things must be right—the fittings *and* the welding. In developing WeldELLS we have kept both of these points in mind. That's why you find in WeldELLS not only everything that can contribute to the soundness of the fitting itself, but also everything that will help the welder do a job *worthy* of the fitting.**

**Take the feature illustrated above—the tangents. These straight segments on each end of every WeldELL keep the weld out of the zone of greatest stress—conform to best engineering practice. But, equally important, they also make it easier for the welder to line up the job and weld it properly.**

**Check down the list of WeldELL features and you will find that WeldELLS give you the means of doing every job as *well* as it can be done—as *easily* as it can be done—and therefore as *economically* as it can be done!**

No other fittings for pipe welding combine these features. In addition to tangents these features are:

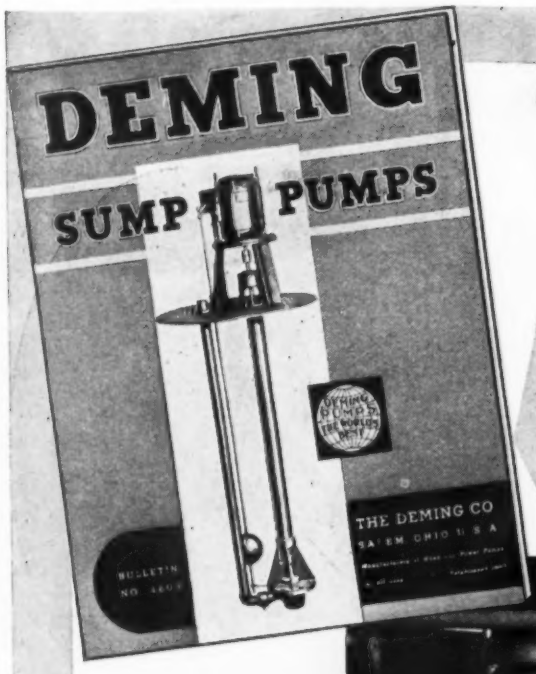
- **Seamless** — greater strength and uniformity.
- **Precision quarter-marked ends**—simplify layout and help insure accuracy.
- **Selective reinforcement**—provides uniform strength.
- **Permanent and complete identification marking**—saves time and eliminates errors in shop and field.
- **Wall thickness never less than specification minimum**—assures full strength and long life.
- **Machine tool beveled ends**—provide best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World**—insures complete service and undivided responsibility.

### TAYLOR FORGE PRODUCTS
*all vital to modern warfare*

WeldELLS are just one of the many Taylor Forge Products that are vital to war and to every branch of war industry. For example: Huge Rolled Steel Rings that are an important part of American tanks now in action.

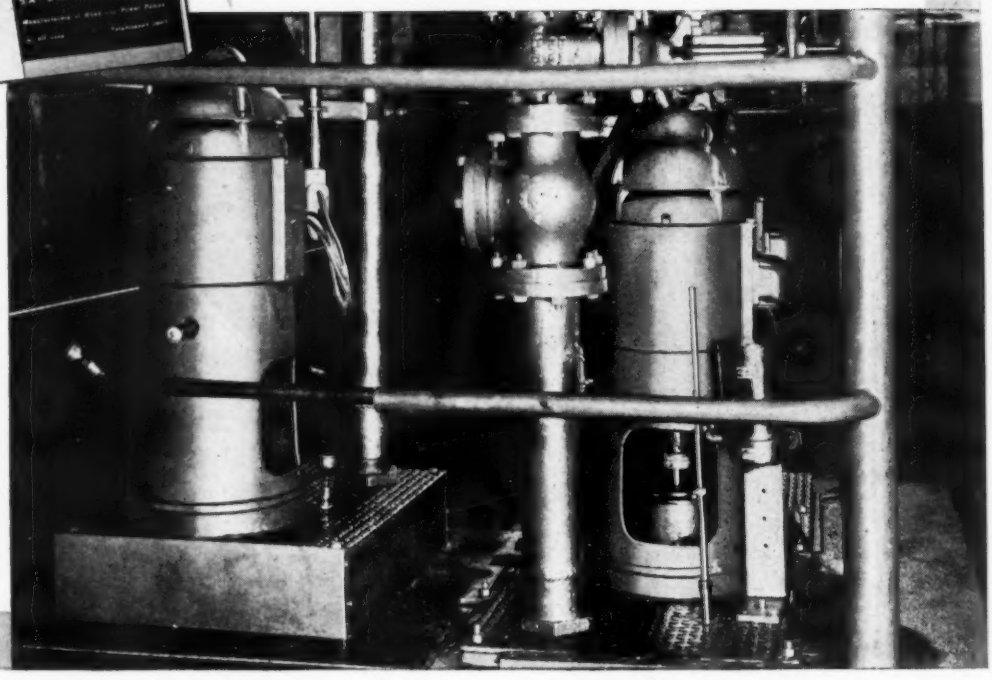
**TAYLOR FORGE & PIPE WORKS**
**General Offices & Works: Chicago, P. O. Box 485**

NEW YORK OFFICE: 50 CHURCH STREET • PHILADELPHIA OFFICE: BROAD STREET STATION BUILDING




# This gives you "POWER of Selection"

Included in BULLETIN No. 4603 are photographs of installations, large views of various types of DEMING SUMP PUMPS, details of construction, performance tables, and other helpful data. Write for a copy. No obligation. No charge.



Deming Vertical Sump Pumps provide wide selectivity of standard types and capacities engineered for many kinds of service.

Capacities of Deming Sump Pumps range from 10 g. p. m. to 3200 g. p. m. with heads up to 120 feet and with motor speeds from 860 to 1750 r. p. m.

Among the long list of owners of one or more Deming Sump Pumps are many of the largest companies in their respective industries. A partial list of these companies appears in Bulletin No. 4603. Send for a copy.

**THE DEMING CO. • SALEM, OHIO**

## DEMING *Industrial* PUMPS

DEEP WELL TURBINES • CONDENSATION RETURN UNITS • SIDE SUCTION CENTRIFUGALS • DOUBLE SUCTION CENTRIFUGALS • SELF PRIMING CENTRIFUGALS • TWO-STAGE CENTRIFUGALS • VERTICAL SUMP PUMPS • CELLAR DRAINERS • SHALLOW AND DEEP WELL PUMPS AND WATER SYSTEMS • JET PUMPS AND WATER SYSTEMS • "TURBO-FLO" PUMPS AND WATER SYSTEMS • TRIPLEX PUMPS • ROTARY PUMPS • PISTON PUMPS

# Any inexperienced person can operate an Ozalid Whiteprint Machine

MISS ARCHER was hired yesterday... and she's already operating the Ozalid Whiteprint Machine at top efficiency... making whiteprints of engineering drawings, charts, and letters in seconds.

This illustrates how Ozalid DRY DEVELOPMENT has revolutionized printmaking — transforming what was once a tedious job into a simple routine. You merely feed the original and the Ozalid sensitized material into the machine. Two quick steps— EXPOSURE and DRY DEVELOPMENT ... and you have positive reproductions which are ready for immediate use in the shop or field.

Compare this simple process with blueprinting, which demands the services of more than one trained operator to check water sprays, potash baths, temperature of drying drums, tension of rollers... in addition to other wasteful operations which throw print production off stride.

Follow the example of thousands of manufacturers who have been convinced of Ozalid's superiority. Install a compact Ozalid Whiteprint Machine in your drafting room. You'll be sure of a "head start" in war production... and savings in labor and materials.

*Write for "Simplified Printmaking," which completely explains the Ozalid Process.*

**SIMPLIFIED PRINTMAKING is an illustrated booklet containing valuable "know how" information. It shows how to eliminate unnecessary drafting; make prints with blue, black, maroon, or sepia lines on a white background; reduce trimming waste; make "new" originals for subsequent print production.**

## Ozalid Products Division

**GENERAL ANILINE & FILM CORPORATION**

**Johnson City, N.Y.**

# COTTRELL PROCESS

*of*

# ELECTRICAL PRECIPITATION

**universally recognized as a**
**standard method of removing**

**DUST, FLY ASH, FUME, MIST & FOG**

***from* GASES**

•

**30 years of research development and operating experience throughout the world is incorporated in the**

**COTTRELL INSTALLATIONS**

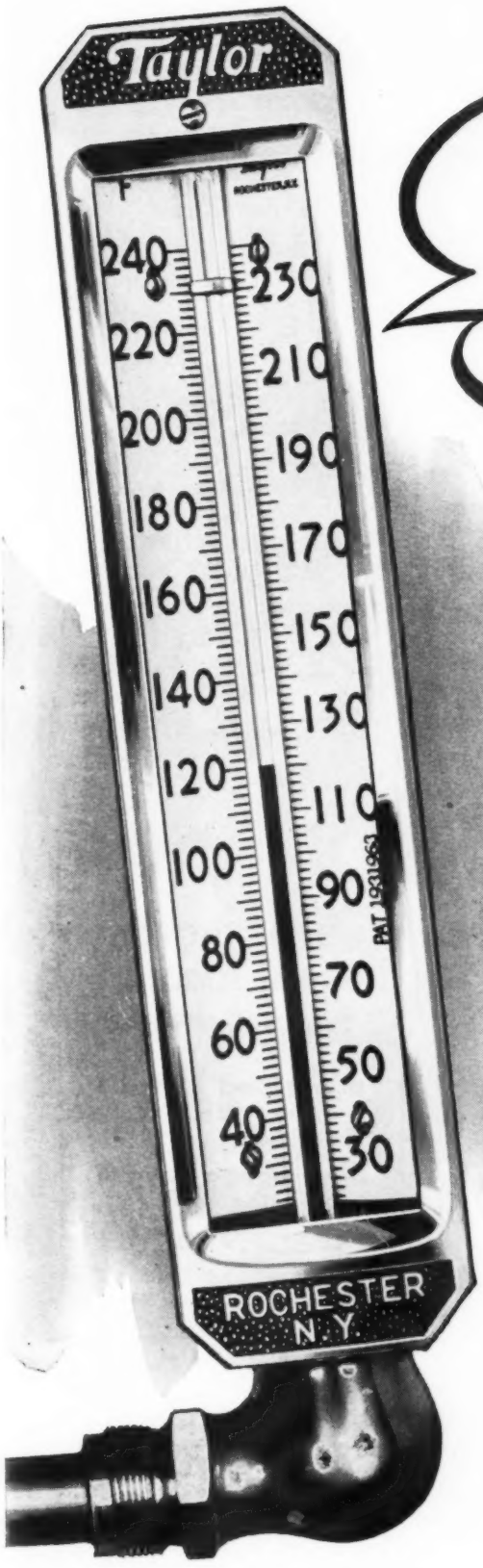
**offered to meet the requirements**
**of any problem by**

## RESEARCH CORPORATION

405 LEXINGTON AVENUE
NEW YORK CITY

59 EAST VAN BUREN STREET
CHICAGO, ILL.

# A THERMOMETER THAT TALKS!




## COME AND READ ME!

IT'S the truth! Taylor Industrial Thermometers actually INVITE you to take frequent readings. Why? Because they're *3 times easier to read*—a real advantage these days when you've got so much else on your mind. The reason is, of course, Taylor BINOC tubing. Instead of squinting at it like ordinary tubing, you can read BINOC tubing easily with both eyes. Here's why—

1. **OPTICALLY CORRECT** *for easy reading.*

2. **WIDE ANGLE OF VISION - HIGH MAGNIFICATION.** *You can see the broad, clear mercury column through more than twice the usual angle.*

3. **THREE LENSES** *gather 3 times the light. Highly magnified mercury column stands out in sharp relief.*

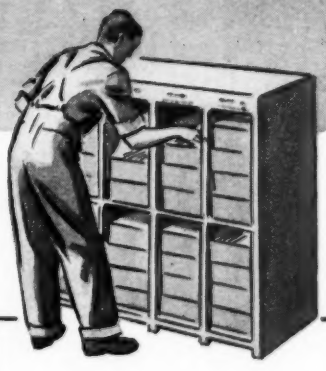
4. **NO CONFUSING BORE REFLECTIONS.** *Empty bore above column never appears to contain mercury.*

Numerals and graduations are exceptionally legible. Taylor Industrial Thermometers with easy-to-read BINOC tubing can be supplied in numerous standard ranges within limits of —40° and +950° F., with a variety of stem constructions to fit any need. Call your Taylor Field Engineer! Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada. *Instruments for indicating, recording, and controlling temperature, pressure, flow, humidity, and liquid level.*

**Taylor Instruments**
**MEAN**
**ACCURACY FIRST**
**IN HOME AND INDUSTRY**

★ KEEP ON BUYING U. S. WAR BONDS AND STAMPS ★

# "Store welding electrodes in a dry place— they will keep indefinitely if properly cared for"



Always keep electrodes in a dry place — on a clean shelf or rack, or at least off the floor. Don't expose them to moisture, keep them away from sweating pipes and open windows. If by accident a box of electrodes should get wet, spread them out to dry immediately.

Follow these simple precautions together with those enumerated at the right — fight waste to speed victory.

A booklet of shop bulletins illustrating "do's" and "dont's" has been prepared to help your welding operators get the most out of every electrode. We'll gladly send you as many copies as you can use.

**WELDING ELECTRODES ARE SCARCE**
**Help Prevent Waste**

- **Do not bend electrodes unless absolutely necessary**
- **Use electrodes down to a 2-inch stub**
- **Fit joints properly before welding**
- **Make legs of fillet welds equal**
- **Make the face of fillet welds flat**

**Air Reduction**

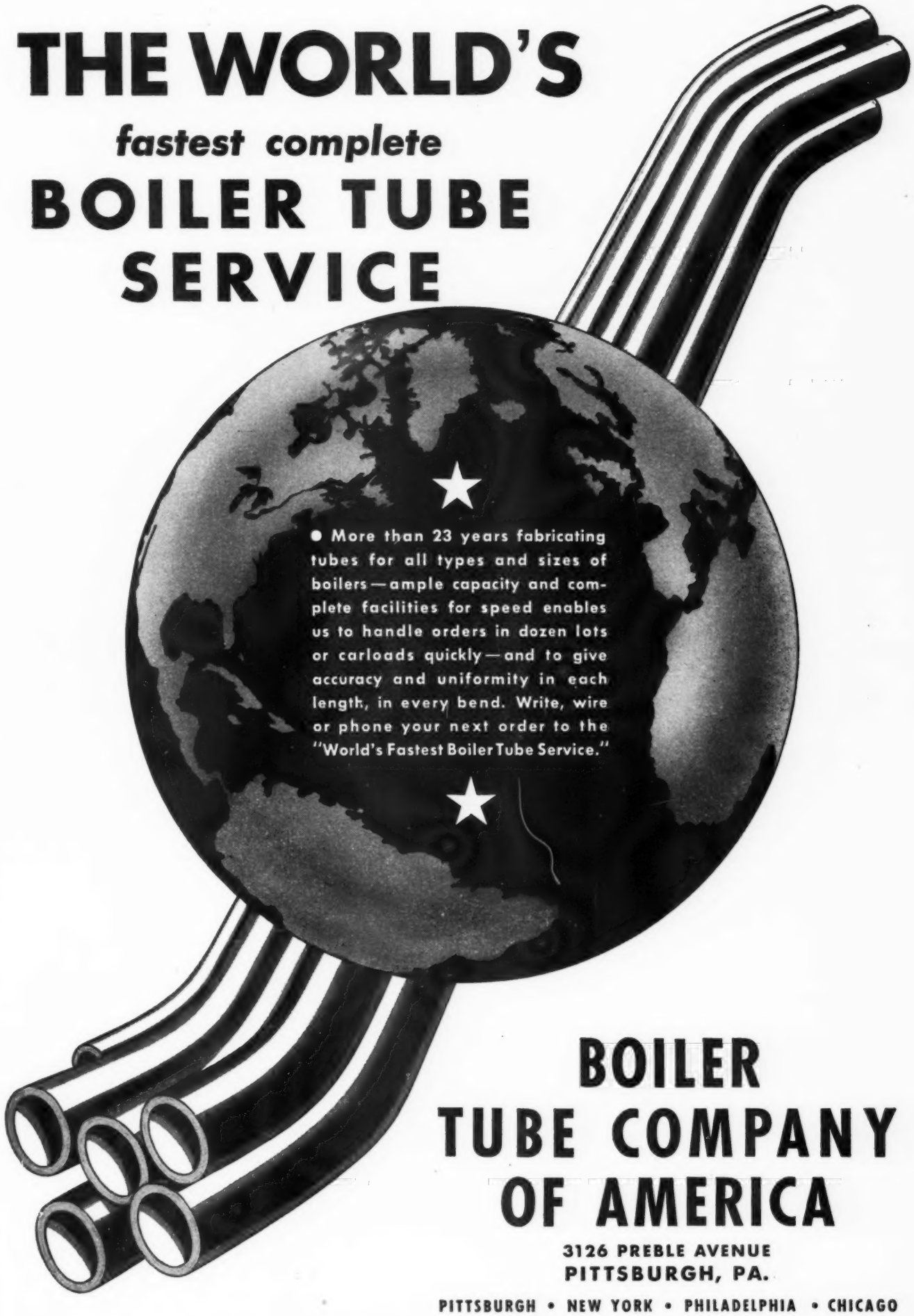
*General Offices:*
60 EAST 42nd STREET, NEW YORK, N. Y.

IN TEXAS
MAGNOLIA - AIRCO GAS PRODUCTS CO.

AIRCO WILSON

**IDLE CYLINDERS ARE PRODUCTION SLACKERS:** *Keep 'em rolling for victory!*

# THE WORLD'S
## *fastest complete*
# BOILER TUBE SERVICE



● More than 23 years fabricating tubes for all types and sizes of boilers—ample capacity and complete facilities for speed enables us to handle orders in dozen lots or carloads quickly—and to give accuracy and uniformity in each length, in every bend. Write, wire or phone your next order to the "World's Fastest Boiler Tube Service."

# BOILER TUBE COMPANY OF AMERICA

**3126 PREBLE AVENUE**
**PITTSBURGH, PA.**

**PITTSBURGH • NEW YORK • PHILADELPHIA • CHICAGO**

# DEPEND ON THIS

# Double Diamond

## When you see it on Fittings

WHEN you use Watson-Stillman high-pressure, high-temperature Forged Steel Fittings for *all* of your needs, you can save yourself trouble *now* and save yourself money *in years to come.* The extra endurance of these Forged Steel "heavy-weights" outweighs their cost. That's true economy, true conservation this year and any year.

The Watson-Stillman line includes screwed fittings and socket welding fittings, designed with more than ample metal sections and built with uniform wall thickness.

90 degree elbows, tees, 45 degree elbows, crosses, street elbows, laterals and crosses are forged solid from steel billets. Couplings, reducers, bushings, caps and plugs are machined from solid bars.

Bulletin A-3 lists all available Watson-Stillman fittings.

## When you see it on Valves

THE double diamond W-S trade-mark on a valve assures you of the same heavy-duty sturdiness that it stands for when you see it on a fitting.

Watson-Stillman makes bronze and forged steel globe, angle and check valves for high-pressure, high-temperature service, therefore giving you a margin of safety on lower pressures.

New valves have been added to make the line of greater use. Like Watson-Stillman fittings, these valves are available through mill supply distributors.

Bulletin A-4 describes and illustrates these valves.

**FREE** *Just write us on your business letterhead and ask for Bulletin A-3 on Fittings and Bulletin A-4 on Valves. The Watson-Stillman Co., Roselle, N. J.*

# WATSON-STILLMAN

Engineers and Manufacturers of Forged Steel Valves and Fittings, Hydraulic Machinery and Equipment—Hydraulic Presses, Pumps and Jacks

# PACK *those* VALVES "*for* KEEPS!"

## *John Crane* EXTRA VALUE *gives many times longer life*

**All-inclusive assortment of packings for superheated steam, hot and cold water and oils, petroleum distillates, air, gases, acids, chemicals . . . Moulded one-piece rings for shut-off, globe, gate and angle valves, cocks . . .** PRICE PACKINGS are "trimmed to the market." When the test comes, they fail. Operation stops; repacking costs become abnormal. It is the costliest method . . . Quality packings, such as "John Crane's," are scientifically fabricated: materials, mechanics and chemistry are fused into an exact unit. You pay somewhat more for it. But stuffing boxes are sealed "for keeps!" It is the money-saving method . . . . . CONSULT CRANE COUNSEL for recommendations.

CRANE PACKING COMPANY, 1800 Cuyler Avenue, Chicago, Illinois
Branch Offices: Baltimore, Boston, Buffalo, Cleveland, Dallas, Detroit, Houston, Los Angeles, New Orleans, New York, Philadelphia, Pittsburgh, St. Louis, San Francisco, Tulsa
CRANE PACKING COMPANY, LTD., Hamilton, Ontario, Canada
Branch Offices: Montreal, Toronto, Vancouver

☆

High pressures . . . Temperatures to 1000°F
on superheated and saturated steam, hot gases
VALVES, VALVE RODS, STEMS
SUPER-SEAL 6AM PLASTIC PACKING

☆ Temperatures to 550°F
general utility on steam, water, air
VALVES, VALVE RODS, STEMS
SUPER-SEAL NO. 1 PLASTIC PACKING

☆ High pressures to 1200 pounds
. . . Temperatures BELOW 550°F
on hot oil, crude oil, gas oil, pressure distillates
HOT OIL VALVES, (ALSO DIPHENYL)
STYLE 100-AL ALUMINUM PACKING

☆ Medium temperatures
on hot and cold water and oils, caustic solutions and acids
VALVES AND STEMS
STYLE 810 SQUARE-BRAIDED ASBESTOS PACKING

☆ VALVES AND STEMS
on gasoline, distillates, solvents
STYLE 1810 BRAIDED ASBESTOS PETROLEUM
RESISTANT PACKING

☆ High and low pressures Medium temperatures
on steam, hot and cold water and oils
VALVE STEMS
SUPER-SEAL VALVE STEM PLASTIC PACKING

☆ MOULDED PRODUCTION RINGS . . . Temperatures to 1000°F
for shut-off valves (steel, brass), globe, gate and angle valves, cocks, etc.
Services: Freon, SO2, NH4, methyl chloride gases, oil and petroleum distillates, saturated steam, hot and cold water, air. Also foods, edible oils, etc.
STYLE 172-D . . . "JOHN CRANE" ENDLESS RINGS (PLASTIC)

# JOHN CRANE *packings*

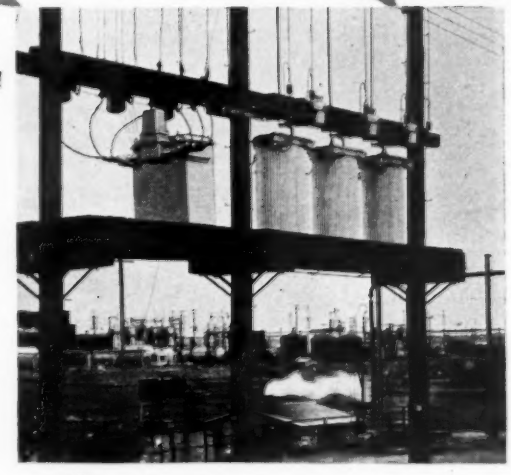
BUY ANOTHER BOND!

# EC&M COMPLETELY ENCLOSED

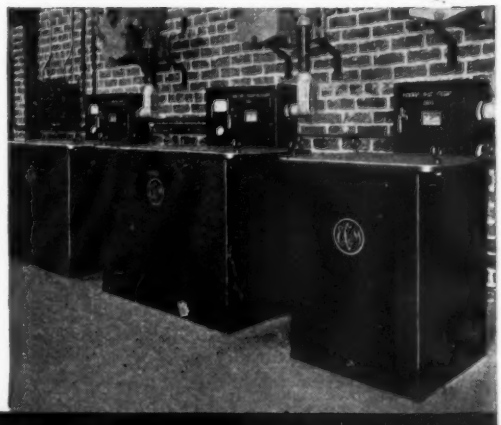
# *Unit Starter*

## FOR 2300-VOLT MOTORS

*Push button operated from low voltage*



*For outdoor mounting and indoor operation*



THIS highly efficient starter for squirrel-cage or synchronous motors offers five definite advantages:

1—Single, quick-break, double-throw Contactor operated by a single magnet, a throw-over spring and a mechanical latch tripped by a Current Limit Relay to cause transition from reduced voltage to full voltage running.

2—Continuous Torque during transition from reduced to full voltage.

3—Self-contained Potential Transformer for 220-volt push button circuit with enclosed fuses also in this circuit.

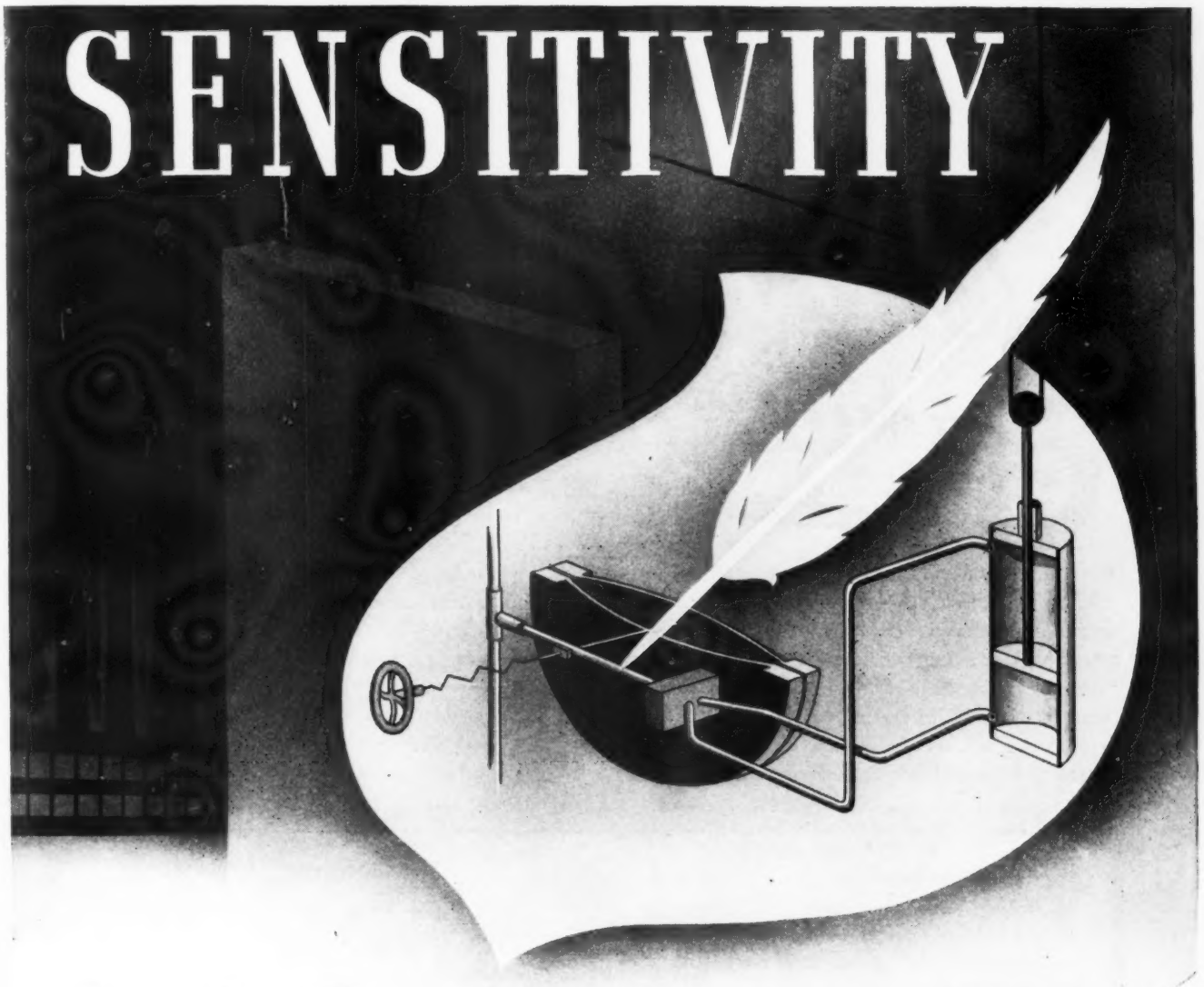
4—Adjustable, magnetic type, two-coil, non-creeping Overload Relays with Inverse Time Element Feature for protecting motors from overheating due to overloads or loss of one phase. Arranged for Magnetic Reset.

5—NEMA Type II (Drip-tight) Enclosure for floor mounting with compensator-mechanism completely oil-immersed.

Arranged for Low Voltage Protection or Low Voltage Release as specified. Ask for Bulletin 1047-C.

**THE ELECTRIC CONTROLLER & MFG. CO.**
CLEVELAND OHIO

# SENSITIVITY



## *1/10 of a Featherweight operates a 4000 POUND DAMPER

**Today Askania is serving our vital industries in a multitude of ways... saving valuable man hours in the complex process of making steel and contributing to increased tonnage of better steel at lower cost ... in the field of prime movers Askania's basic simplicity and sensitivity plus its rugged durability are proving themselves in the savings ... protection and increased production effected. An Askania bulletin pertinent to your problems awaits your inquiry ... address Askania Regulator Co., Cor. 16th and Michigan, Chicago**

JET PIPE PRINCIPLE

*Specifically .001" W. C.

**ASKANIA**
REGULATOR CO. CHICAGO
*AUTOMATIC CONTROL*

# CONVERTING TO COAL?

## HERE ARE A FEW CASE STUDIES WHICH MAY PROVE HELPFUL!

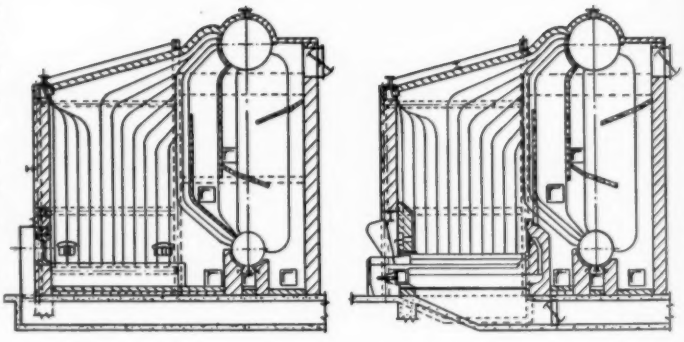
Conversion of oil-fired boilers to burn coal with minimum sacrifice of capacity and efficiency requires a competent analysis of the several factors affecting the selection of coal burning equipment.

A knowledge of these factors and how to evaluate them is essential to satisfactory results on any conversion project. As a means to a closer understanding of the varied conversion problems ordinarily encountered, a group of actual case studies are here illustrated and briefly discussed.

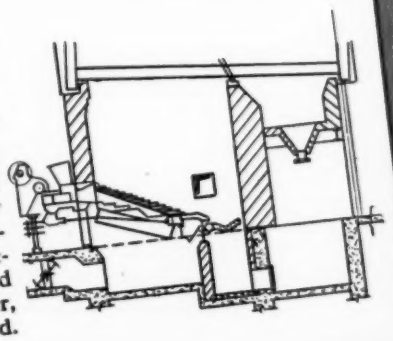
Combustion Engineering, having at its disposal the most complete line of fuel burning equipment available to any manufacturer, is singularly well equipped to work with your engineers or consultants to select the type of equipment best suited to your particular requirements.

**For additional information write for pamphlet — "Factors Governing Conversion from Oil to Coal Firing"**

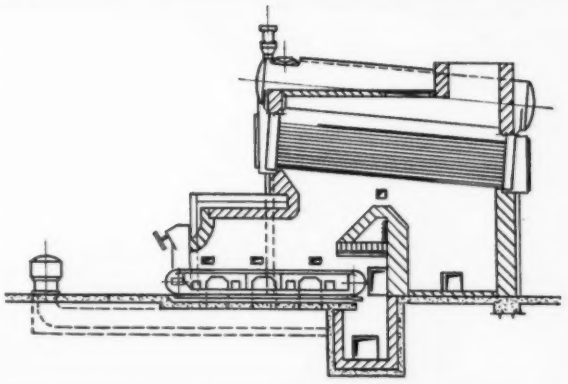
The left-hand illustration shows a 35,000 lb capacity oil fired steam generator as originally installed in a Connecticut industrial plant. The coal available was a good grade Eastern bituminous, suitable for either stoker or pulverized fuel conversion. The plant is located in a populous area and dust nuisance was to be avoided. After studying the situation, a type E, single-retort, underfeed stoker was selected. Only minor alterations to the setting and underfloor construction were required as shown by the right hand view.



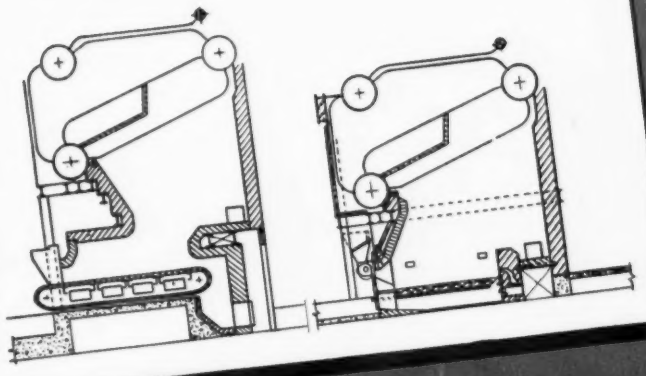
This sectional header boiler was originally installed in a Maryland plant to produce 62,000 lb of steam per hour when oil fired. The coal available to this plant was coking and caking bituminous suitable for underfeed, spreader or pulverized fuel conversion. The furnace had no water-cooled wall protection and was of limited volume. This virtually ruled out both pulverized fuel equipment and the spreader stoker as practical applications. The capacity required was too large for a single retort stoker, so a C-E Multiple Retort was selected. Its application is illustrated at right.



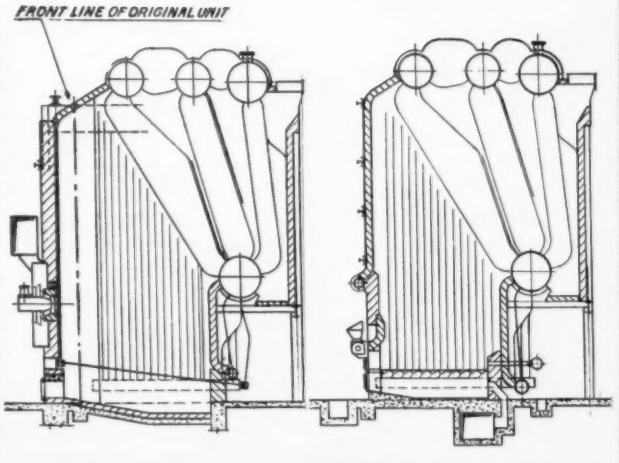
This 20,000 lb capacity box-header boiler was originally installed for oil firing in an area where anthracite was the coal most economically available. The logical equipment for coal firing, therefore, was a traveling grate stoker. Original furnace front wall, indicated by dotted lines, was removed and a dutch oven was added; likewise a rear arch and a bridgewall. Since there was no basement, underfloor construction was kept to a minimum by providing a moderately-sized ash pit extended at the side of the unit for removal of the refuse.



The drawings at the right illustrate an unusual conversion problem. Originally oil fired, this boiler is located in an area where anthracite is the low cost fuel. This would indicate the use of a traveling grate stoker. However, the boiler is set on a thick concrete mat only 2 feet below the normal operating floor. Obviously to raise the boiler, as shown at the left, to accommodate a traveling grate setting would be a difficult and costly operation. The relatively simple changes involved in making a good spreader stoker installation, as shown at the right, justify its selection even though it requires a more expensive coal.



The bent tube boiler shown here was designed to produce 75,000 lb steam per hour when oil fired. The setting was substantially as shown at the right. The available coal was suitable for either spreader stoker or pulverized coal firing. However, the furnace volume was inadequate for a satisfactory pulverized fuel conversion, and would have required moving out the front wall, adding a water screen above the furnace bottom, deepening the ash pit, as shown at the left, and of course, the purchase of the coal pulverizing and burning equipment. The spreader stoker required only revision of the lower front wall, building a stub bridgewall and providing a suitable air duct. Naturally the latter change was much less costly for both equipment and construction, and the studies revealed that the sacrifice in efficiency would scarcely justify the more expensive installation. In other cases, however, the advantages of higher efficiency and the flexibility of pulverized coal operation may well justify its selection over stoker firing.




COMBUSTION ENGINEERING
COMPANY, INC., 200 Madison Avenue, New York, N. Y.
A-704
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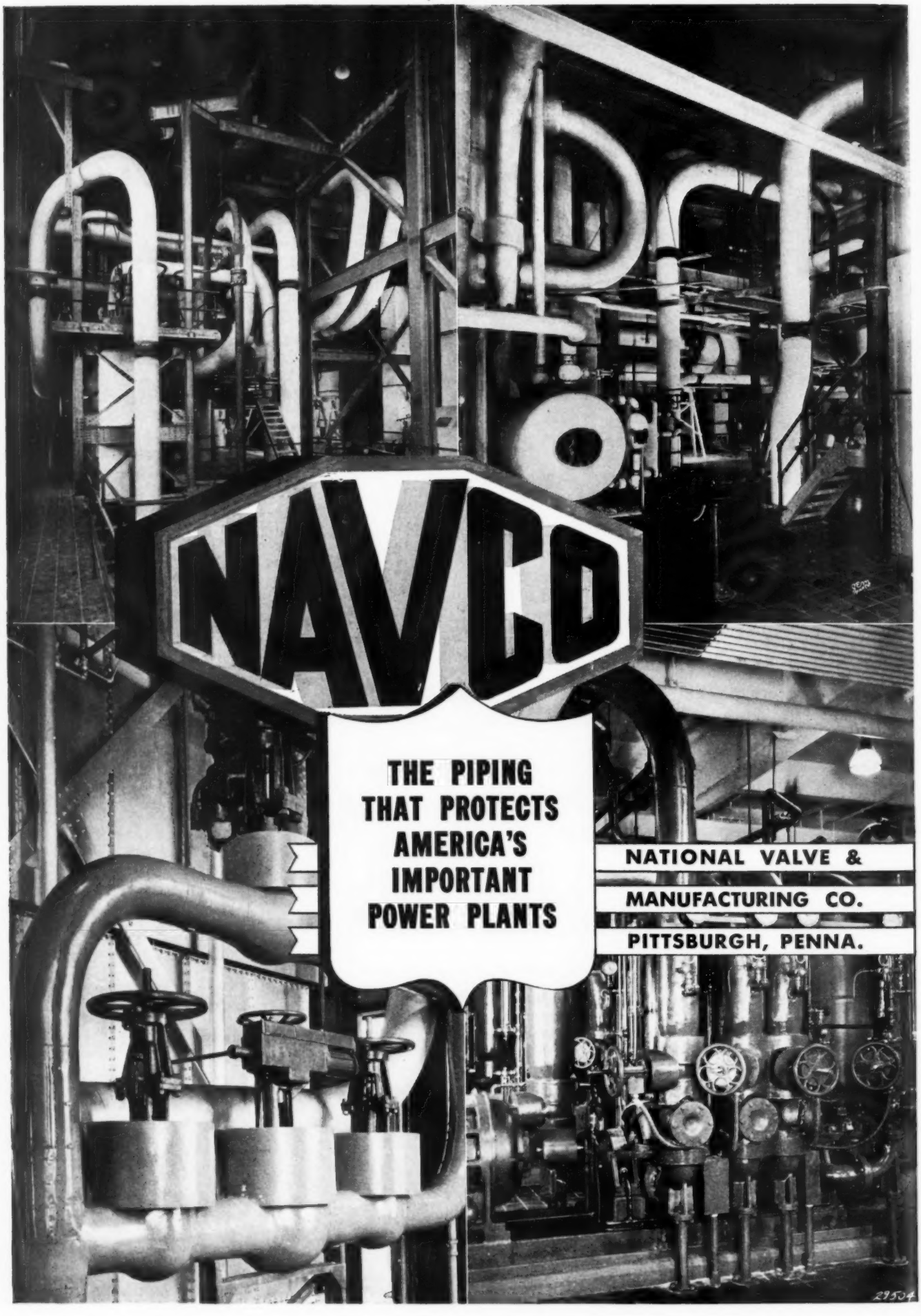
NAVCO
THE PIPING
THAT PROTECTS
AMERICA'S
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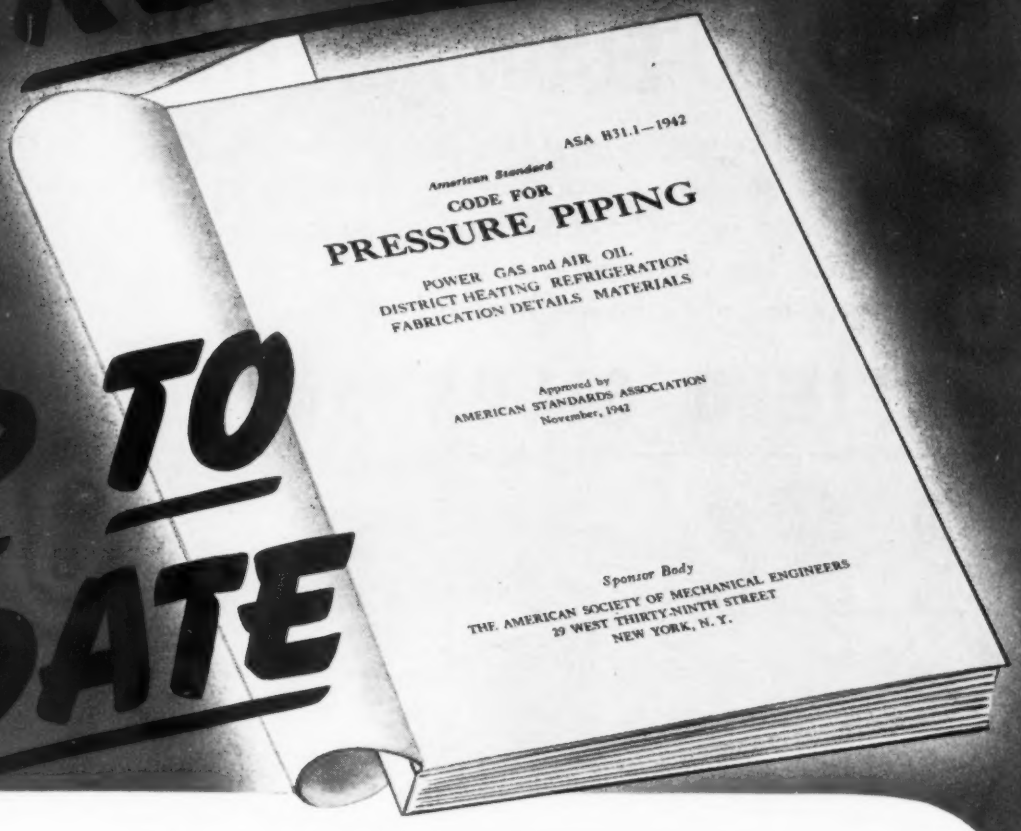
PITTSBURGH, PENNA.

# REVISED

# UP TO DATE




## FOR BETTER PRESSURE PIPING

First issued in 1935 by the American Society of Mechanical Engineers and approved by the American Standards Association, the "Code for Pressure Piping" has proved of vast benefit to everyone concerned with pressure piping.

It provided codified, detailed information on selection of materials... dimensional standards... maximum allowable stresses... fabrication details such as welded joints, flange joints, welding procedure, hangers, testing, etc.

Now, the Revised Code is ready. It brings all material up to date in the light of most recent practices resulting from the large amount of development and research which the past seven years have seen.

This new Code has, of course, been adopted by all qualified pipe fabricators. Its use is essential to the pre-fabrication of high-grade pressure piping . . . piping which is easier to install and more economical.

Consulting engineers, piping designers, owners and contractors will find this Revised Code invaluable. The Pipe Fabrication Institute will send it on request at the established price of $2.00 per copy.

**THE PIPE FABRICATION INSTITUTE**

P.F.I. THE PIPE FABRICATION INSTITUTE

*Devoted to the Technical and Economic Problems in Piping*

1108 CLARK BUILDING • PITTSBURGH, PA.

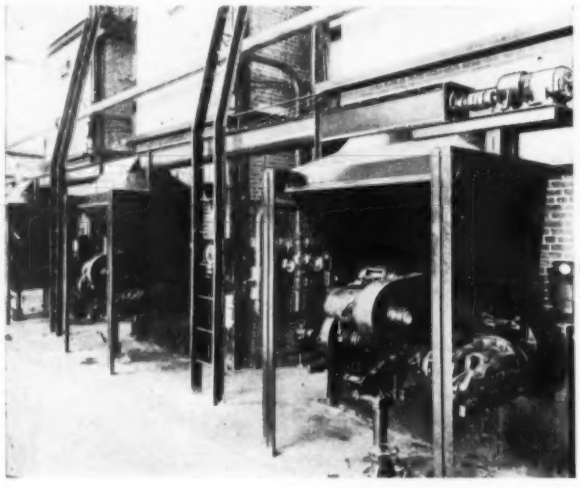
FUEL OIL HAS GONE TO WAR

# *Make Your Conversion to Coal*

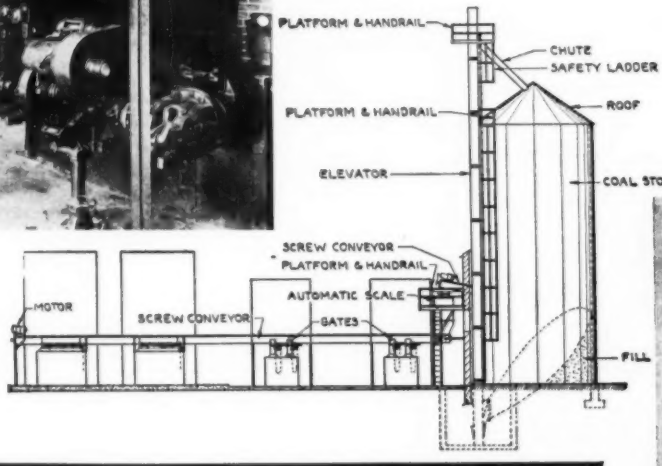
# SIMPLE • ECONOMICAL • LASTING

The rapid conversion of power plants in the East, from oil to coal is fast moving West. A trend now is a National Emergency. Meanwhile, this Company has been helping many of these converted Eastern plants with their coal storage and coal handling problems, particularly, in cases where many of these plants have not been built with any available space for coal storage.

## FAIRFIELD SILOS and CONVEYORS



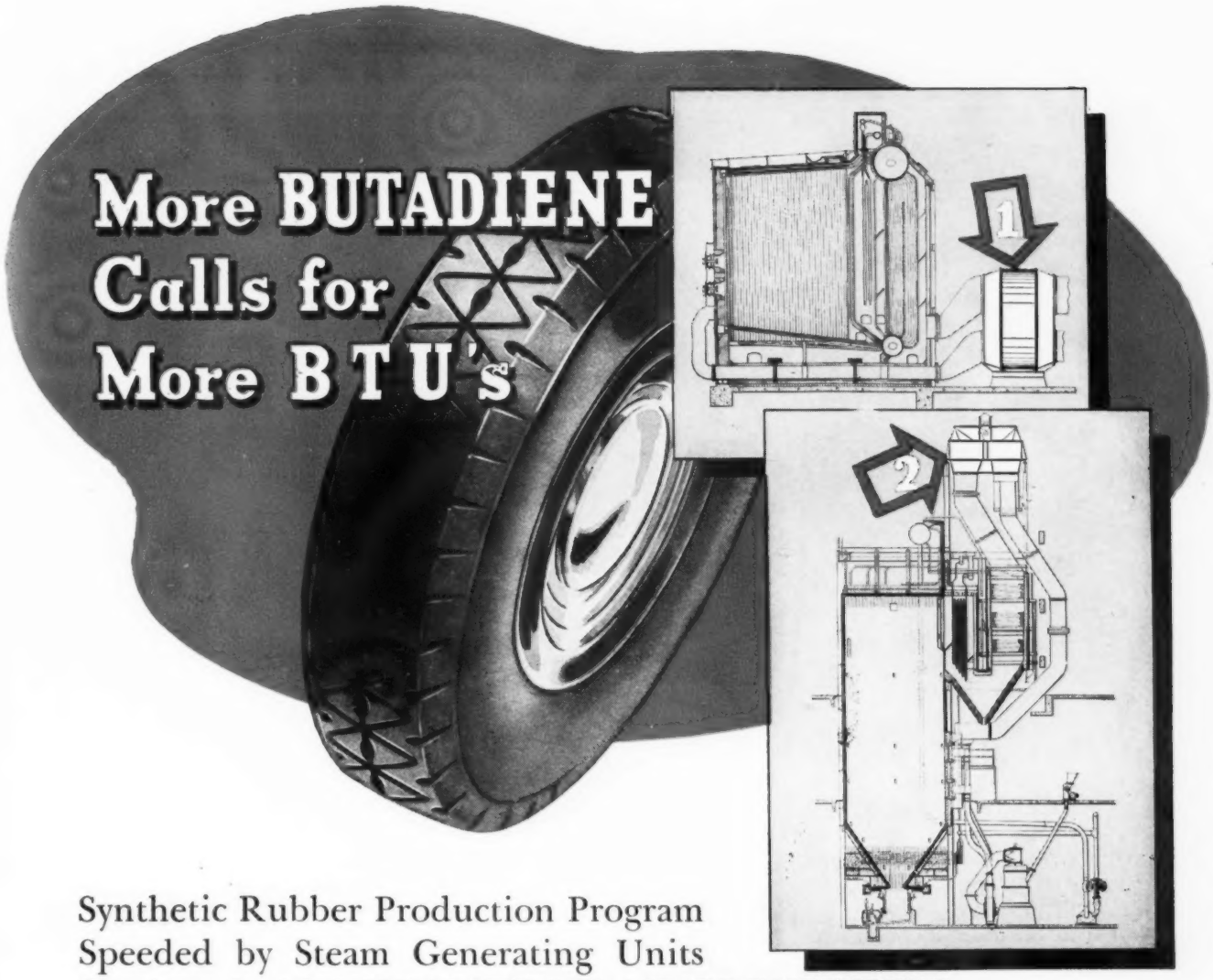
— have proven the solution to the change over, in all these cases. Also in plants, now burning coal, but finding it necessary to modernize antiquated or inadequate equipment.



Note how Silo is built outside boiler house . . . no building changes necessary . . . a most efficient and economical method of storing coal . . . easily adapted to plants requiring 200 to 1000 tons storage . . . built of vitrified tile . . . will not absorb moisture . . . wall construction also insulates against freezing . . . elevating equipment generally used, skip hoist or bucket elevator . . . conveying system to boilers either Screw Conveyors or Weigh Larries.

Write today for New Catalog, full of illustrations, photographs, and drawings of typical installations. Let's get acquainted. Ask for Catalog No. 140.

**THE FAIRFIELD ENGINEERING CO., — MARION, OHIO**




## Synthetic Rubber Production Program Speeded by Steam Generating Units Equipped with LJUNGSTROM AIR PREHEATERS

*Two typical steam generating units designed for refineries which are making butadiene are illustrated above, each equipped with a Ljungstrom Air Preheater. Furnace No. 1 has a capacity of 300,000 lb. of steam per hr. Gases enter the preheater at 735 deg. F., leave at 380 deg., heating the combustion air to 532 deg. In No. 2 furnace, capacity of 350,000 lb. per hr., gases enter the preheater at 700 deg. F., leave at 390 deg., heating combustion air to 550 deg.*

• • •

The report of the Baruch Rubber Survey Committee highlights the call for more butadiene . . . the key factor in the production plan for some 370,000 tons of Buna S synthetic rubber.

But back of the need for more butadiene is a need for more process steam. New boiler plant capacity has to be added in a hurry, yet with the greatest possible conservation of steel.

Significantly, almost all of the power plants for this purpose now built or building are equipped with Ljungstrom Air Preheaters, despite a wide variation in other details of design. In addition, Ljungstroms are being used on the separately fired superheaters, and on the petroleum refining furnaces which help to supply the raw material.

Using a continuous regenerative counterflow principle, Ljungstrom Air Preheaters give the maximum transfer of heat from flue gas to combustion air with the minimum of equipment weight and size. In installation, they save steel and save time. In operation, they save fuel and contribute to continuity of service. For information on their application to any gas-to-air heat transfer problem, write:

**THE**

# AIR PREHEATER

**CORPORATION**

**Executive Offices: 60 East 42nd Street, New York, N. Y. • Plant: Wellsville, New York**

*Looking ahead with Asbestos*

Hard-boiled sentries, K&M asbestos packings are on guard now, and will be in the future, at valves and fittings, to see that precious steam, gas, acid, water, oil—as the case may be—does not escape. On guard, in fact, to plug many leaks that can add up to inexcusable and costly waste.

K&M Packings are so effective at sealing a machine—and keeping it so—that for some time the war effort has been taking all that Keasbey & Mattison can make.

Though the war is giving new impetus to industrial design, it is impossible to imagine change so revolutionary as to by-pass these asbestos-based packings that have served Industry efficiently for many years. No, when peace returns K&M Packings will resume their "plugging" for civilian industry, full-time.

In the meantime, K&M research continues to expand the usefulness of asbestos, and invites you to suggest ways in which Nature's strangest mineral might better serve you.

* * *

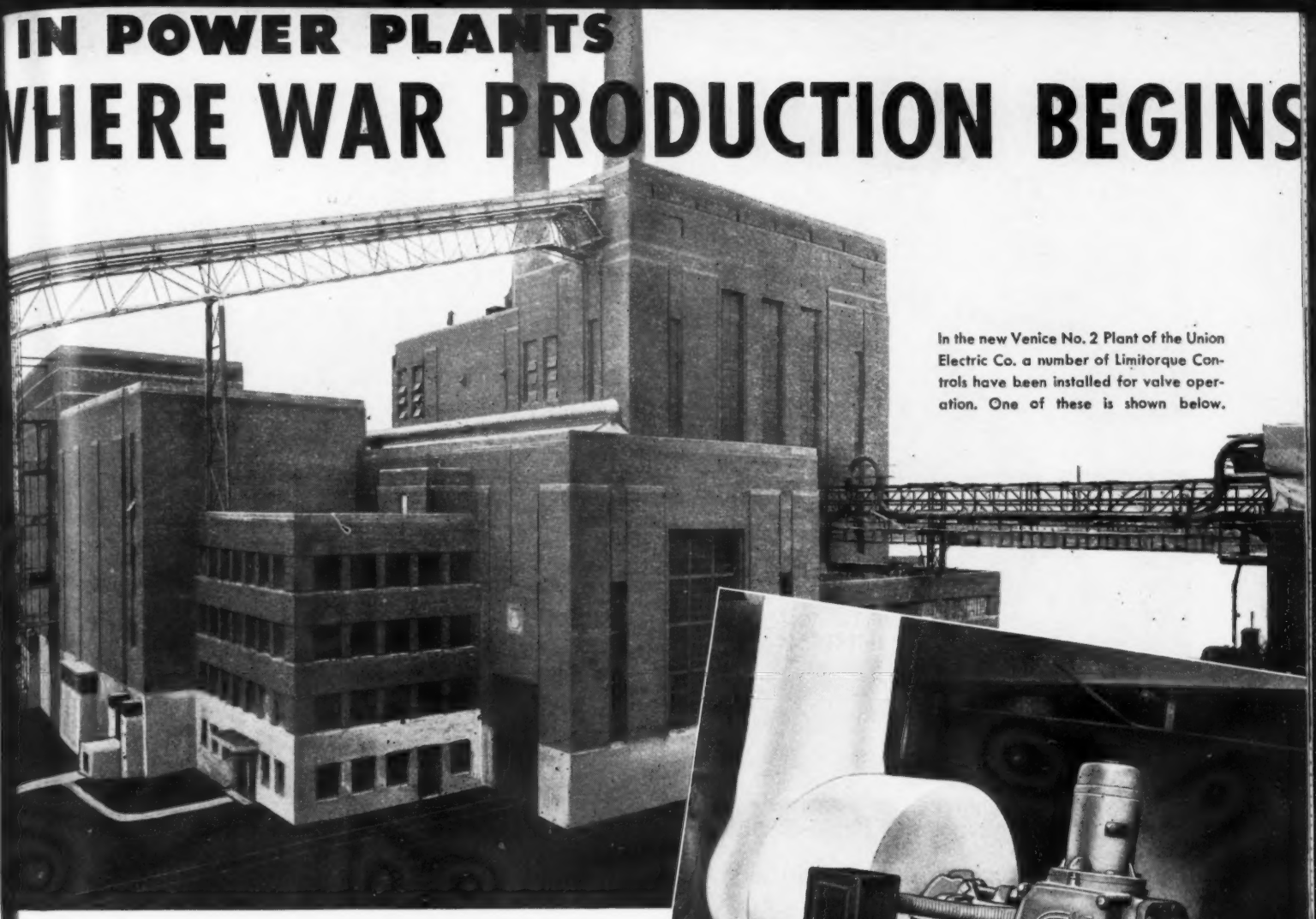
*Nature made asbestos;*
*Keasbey & Mattison, America's asbestos pioneer,*
*has made it serve mankind . . . since 1873*

**KEASBEY & MATTISON**
**COMPANY, AMBLER, PENNSYLVANIA**

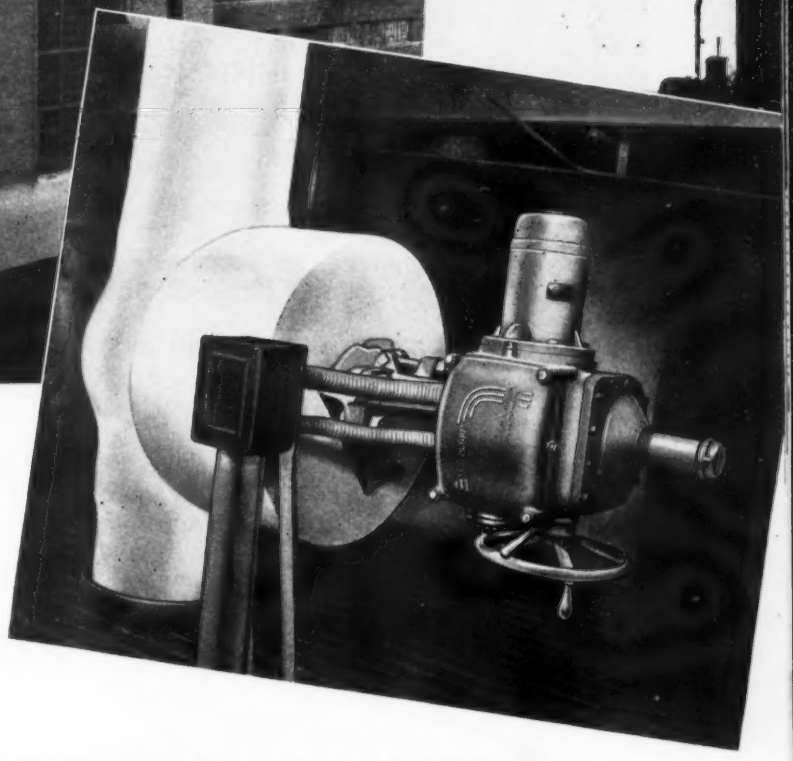
*Makers of*

asbestos-cement shingles and wallboards; asbestos and magnesia insulations for pipes, boilers, furnaces; asbestos textiles; asbestos electrical materials; asbestos paper and millboard; asbestos marine insulations; asbestos acoustical material; asbestos packings; asbestos corrugated sheathing and flat lumbers; asbestos-cement pipe for water mains

# IN POWER PLANTS
# WHERE WAR PRODUCTION BEGINS



In the new Venice No. 2 Plant of the Union Electric Co. a number of Limitorque Controls have been installed for valve operation. One of these is shown below.



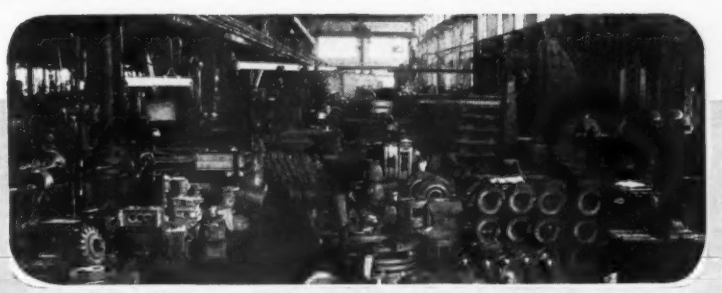
## LIMITORQUE CONTROLS SIMPLIFY VALVE OPERATION

Supplying the power to turn out weapons for victory is a big part of the job of Power Plants today. Hard pressed to meet all demands, the simplification and speeding up of routine operations in the plant is vital. A step in the right direction is the installation of LimiTorque Controls on all types of valves from 3" to 96" diameter. With LimiTorque, valves can be opened or closed surely and quickly by just pushing a button at a conveniently located individual station or from a master control panel. Whether for new installations or for securing better control in existing stations—investigate LimiTorque. It can be fitted to your present equipment. Write us for further details.

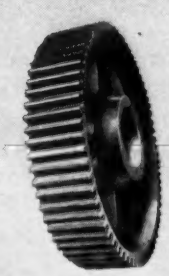
# PHILADELPHIA GEAR WORKS

**INDUSTRIAL GEARS**
**AND SPEED REDUCERS**
**LIMITORQUE VALVE CONTROLS**

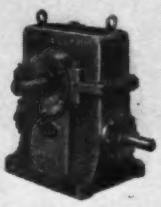
**ERIE AVENUE & G STREET**
**PHILADELPHIA, PA.**
New York, Pittsburgh, Chicago



***Philadelphia***
**LIMITORQUE CONTROL**
operates all types of valves, etc., safely, economically, from convenient stations.



***Philadelphia***
**GEARS**
All types and sizes of industrial gears. Can be supplied in all materials.



***Philadelphia***
**WORM GEAR SPEED REDUCER**
right angle drives—vertical or horizontal. Wide range of ratios and horsepowers.

***Philadelphia***
**MOTOREDUCER**
The economical self-contained drive, Horizontal or Vertical types — various ratios and horsepowers.

***Philadelphia***
**HERRINGBONE SPEED REDUCER**
for heavy loads at high speed. Single, Double, Triple Reductions, various ratios and horsepowers.

## Don't overlook this hidden factor

**Both N.E.M.A. and A.S.A. Standards specify that general-purpose electric motors shall be suitable for carrying CONTINUOUSLY a load of 1.15 times the rated load. Thus, a 5 hp. motor can carry 5¾ hp.**

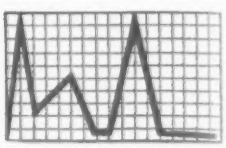
**Make use of this. Save a frame size and S-T-R-E-T-C-H vital materials — copper, steel, aluminum.**

WITH *copper* one of our most critical materials it's *our* job and *your* job to see that it gets to the spot where it does the most damage to our enemies. You want more motors. We shall have less copper for building them.

*Here are some of the things that can be done about it:*

Make more careful studies of machine loads. Don't overmotorize just to "play safe." We are in a spot where we must do some conservative gambling.

**CHECK DUTY CYCLE . . . .** Maybe an intermittent-duty motor will do, using a frame size smaller than the continuous-duty motor.



**CHECK TORQUE REQUIREMENTS.** Maybe a motor with special torque characteristics will take a frame size smaller and save vital materials.

**CHECK SPEEDS.** If it's a constant-speed motor, save a frame size by going to next higher speed, 1200 rpm. instead of 900 rpm.; 1800 rpm. in place of 1200 rpm.

If it's an adjustable-speed d-c. drive, can you get by with a higher minimum speed? A 1 to 3 range instead of 1 to 4? For example, using 500-1500 rpm. in place of 400-1600 rpm. saves a frame size.

Could you get along with a single-speed a-c. motor or a single-winding multi-speed motor instead of a two-winding multi-speed motor?

**CHECK VOLTAGES.** Specify single-voltage a-c. motors. They use but 3 leads instead of 9.

This job involves Application Engineering, which is our business. Reliance men skilled in this work are ready to help and are available in the industrial centers listed below.

**RELIANCE ELECTRIC & ENGINEERING COMPANY**
**1088 IVANHOE ROAD • CLEVELAND, OHIO**

BIRMINGHAM • BOSTON • BUFFALO • CHICAGO • CINCINNATI • DETROIT
GREENVILLE, S. C. • HOUSTON, TEXAS • LOS ANGELES • MINNEAPOLIS
NEW YORK • PHILADELPHIA • PITTSBURGH • PORTLAND, ORE. • ST. LOUIS
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**RELIANCE A-C D-C MOTORS**

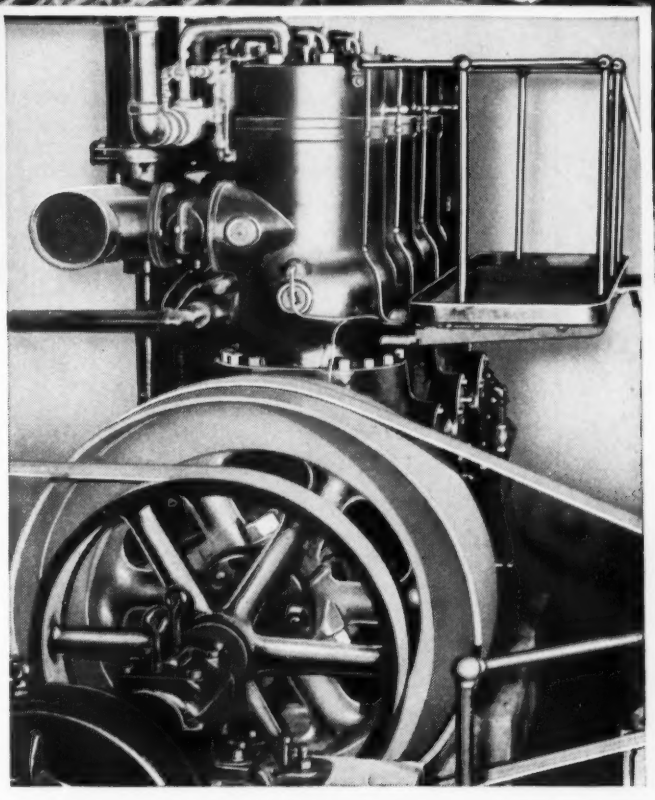
# POWER

## ...TO FINISH THE SCRAP!

SCRAP metal helps win wars! To simplify handling at its Portland, Me., plant, the Harcon Iron and Steel Company compresses old metal into compact 400-lb. cubes. And it takes plenty of reliable power to do the job!

For "power to finish the scrap," a 180-hp. Fairbanks-Morse Diesel is direct-connected to a pump which actuates a mammoth hydraulic press. It also drives an F-M generator which provides electricity for lighting.

If you require extra power for war production, use your priority to buy Fairbanks-Morse Diesels. They assure *low unit power costs* . . . plus no stoppage, no breakdowns, no letdowns — *now* or later! Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Illinois.



*• Compact 180-hp. F-M Diesel Power Plant at Harcon Scrap Metal Yard operates pump, generator, and compressor.*

# FAIRBANKS-MORSE

DIESEL ENGINES
PUMPS
ELECTRICAL MACHINERY
SCALES
MOTORS

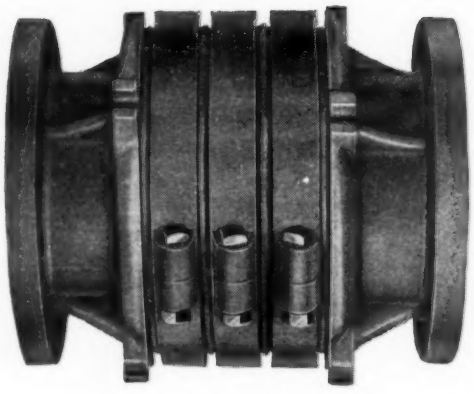
WATER SYSTEMS
AIR CONDITIONERS
FARM EQUIPMENT
STOKERS
RAILROAD EQUIPMENT

F M

# Diesels

# DIRECTED FLEXING

**. . . TWO BADGER WORDS THAT MEAN LONGER LIFE AND GREATER UTILITY FOR EXPANSION JOINTS**



DIRECTED FLEXING—made possible by a special *ALL-CURVE* corrugation—is an exclusive feature of all Badger Self-Equalizing Expansion Joints.

With the ALL-CURVE corrugation, Badger scientifically controls the flexing movement . . . keeps all flexing stresses distributed. There are no "junctions" between straight sides and curves where stresses tend to localize. Each ALL-CURVE corrugation has an ALL-CURVE equalizing ring . . . flexing movement is not only *limited* but *progressively controlled.*

*Directed Flexing is only one of the many reasons for Badger's leadership in the design and manufacture of Expansion Joints. Badger Joints protect equipment, minimize costly shut-downs, require no servicing, are easily installed, are scientifically heat-treated throughout fabrication.*

**BADGER NON-EQUALIZING EXPANSION JOINTS—** Widely used as a connection between piping and equipment, or between adjacent equipment, to absorb expansion, contraction and vibration.

## E. B. Badger & SONS CO.

**75 Pitts Street, Boston, Mass.**

*AGENTS IN PRINCIPAL CITIES*

# IN DESUPERHEATING SERVICE . . .

## "THIS PUMP HOLDS TEMPERATURES WITHIN ±1° F."

### UNDER FULLY AUTOMATIC CONTROL

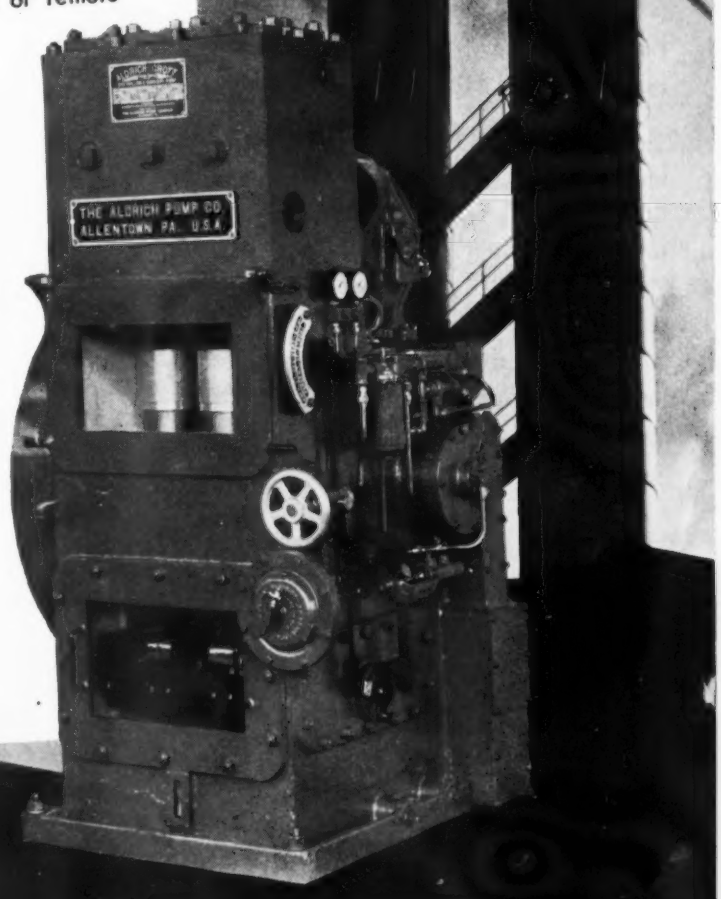
In an eastern public utility station, an Aldrich-Groff controllable capacity "Powr-Savr" Pump has been in almost continuous operation for nearly three years, supplying water for desuperheating steam. Arranged for automatic temperature control, its response is such that "the indicating and recording instruments show a total variation of only 1° F. from the desired temperature". This pump has a variable capacity from 0 to 65 GPM at a constant pump speed of 190 RPM against 350 lbs. pressure and is driven by a 20 HP 1750 RPM constant speed A.C. motor.

Aldrich-Groff Pumps provide for automatic or remote manual control of delivery from zero to full rated capacity at constant pump speed. Rate of delivery is controlled by variation of the length of plunger stroke and power consumption is almost directly proportional to pump delivery. They offer the advantages of feed system simplicity, efficiency and mechanical reliability of the small and medium boiler plant using medium or high steam pressures, and for desuperheater feed service in even the largest power stations.

Write for bulletins and material giving full details, sizes and ratings of Aldrich-Groff Pumps.

**THE ALDRICH PUMP COMPANY**

**ALLENTOWN · PENNA.**



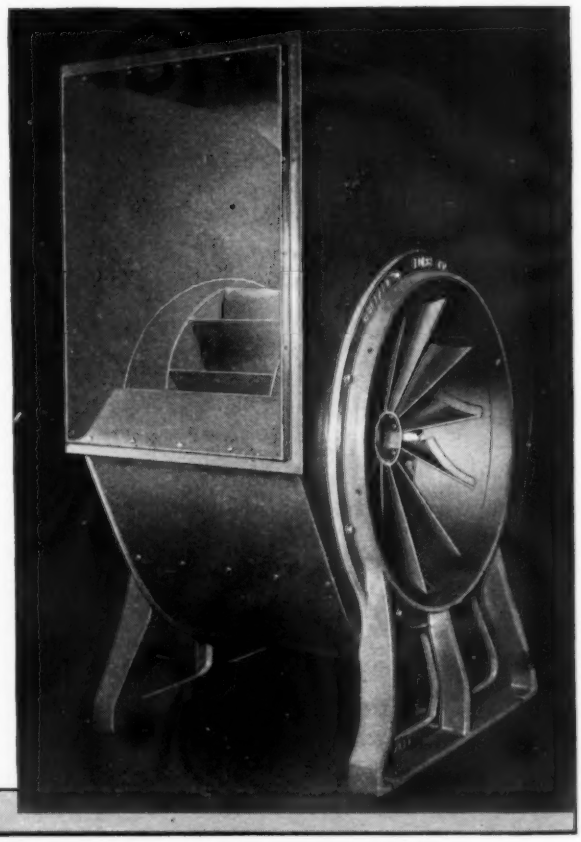

**THE ALDRICH-GROFF CONTROLLABLE CAPACITY "POWR-SAVR" PUMP**

TRADE MARK

## BUFFALO FORGE WORKERS HONORED BY ARMY-NAVY PRODUCTION AWARD

● With pride, the entire organization of the Buffalo Forge Company welcomes this new banner which now joins Old Glory over its plant!

The Army-Navy Production Award "for high achievement in war production" means to the workers at Buffalo Forge the recognition of their determination to see production's job through—efficiently and swiftly. The "E" Flag flying over their plant and the "E" emblems proudly displayed on their lapels shall serve as an unfailing inspiration to carry on with ever intensified effort and cooperation—to hasten the ultimate Victory of our armed forces.



To the Army and the Navy, the Buffalo Forge organization takes this opportunity to express publicly its deep appreciation of this signal award!

"Buffalo" ★

Heating and Ventilating Equipment for Ordnance Plants, Bomber Factories and Ships; Air Conditioning for "Blackout" Plants, Food Product Factories, Synthetic Rubber Plants; Machine Tools including Drilling Machines, Power Punches, Shears and Bar Cutters used in the manufacture of tanks, trucks, aircraft and ships, guns and shells.

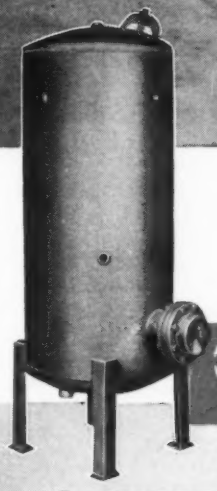
**BUFFALO FORGE COMPANY**

488 Broadway Buffalo, N. Y.

*Branch Offices in Principal Cities*

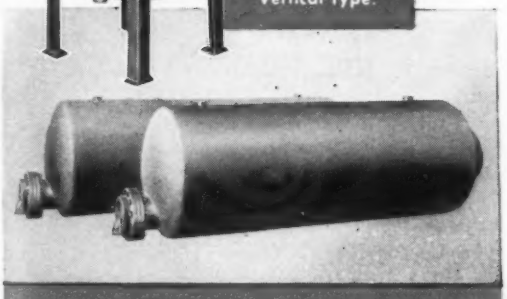
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

# SOLVE YOUR HEATING PROBLEMS WITH AN ADSCO BUILT-TO-ORDER HEATER...



ADSCO Storage Water Heater, Vertical Type.

## 60 YEARS OF KNOWING HOW *are built into every* ADSCO *Heater*

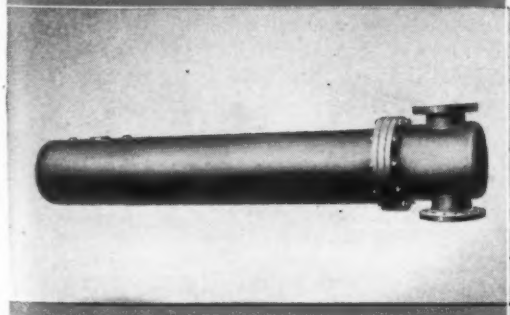


ADSCO Storage Water Heater, Horizontal Type.

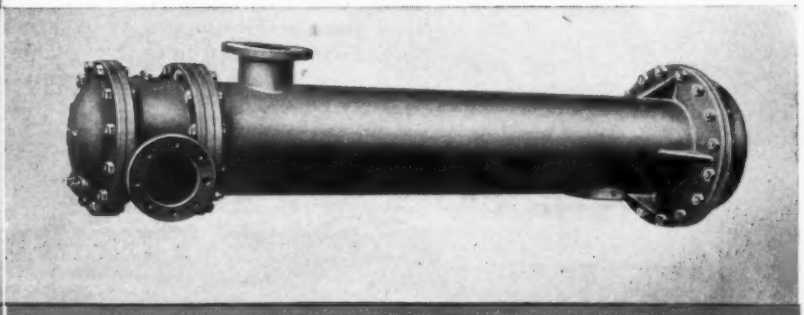
Since the "early eighties" ADSCO has been gaining the experience that is reflected today in the quality and efficiency of its heaters. Submit your heater problem to ADSCO engineers who will tell you the type, size, capacity, pressure and construction that will meet your needs and latest code standards. ADSCO can provide steel or copper tubing in accordance with governmental regulations in effect.

Whether it is a storage of instantaneous unit—a horizontal or vertical heater, fuel oil heater or heat economizers, if it bears the name ADSCO, it is bound to give satisfaction.

**AMERICAN DISTRICT STEAM COMPANY**
NORTH TONAWANDA, N.Y.



ADSCO Instantaneous Heater, U-Tube Type.



ADSCO Instantaneous Water Heater, Straight Tube Type.

# WOLVERINE SALUTES
## THE TEN WINNERS

**In recognition of their noteworthy contributions to the war effort, ten men were invited to the White House on December 10 to receive individual awards personally bestowed on them by President Roosevelt.**

**In this ceremony, the first of its kind in the country's history, six of the workers, chosen from the war industries in cooperation with local labor-management committees, received Citations of Individual Production Merit, signed by Donald M. Nelson; and the four other workers received Certificate Awards.**

**Wolverine's salute to these men carries a deep feeling of pardonable pride because among them is one of our own men, Walter P. Hill, whose development of a new process of manufacturing primer tubes is now used in the firing mechanism of millions of large shells. Through his untiring efforts many worthwhile savings in critical materials have been effected, and great reductions have also been made in man-hours and machine time.**

WALTER P. HILL
*"Production Soldier"*

**The Citation Award winners, in addition to Hill, are: Joseph H. Kautsky, Link-Belt Co.; Clinton R. Hanna, Westinghouse Electric and Mfg. Co.; Edwin Curtiss Tracy, RCA Manufacturing Co.; Madison E. Butler, Stromberg-Carlson Telephone Mfg. Co.; and James A. Merrill, Goodyear Tire and Rubber Co.**

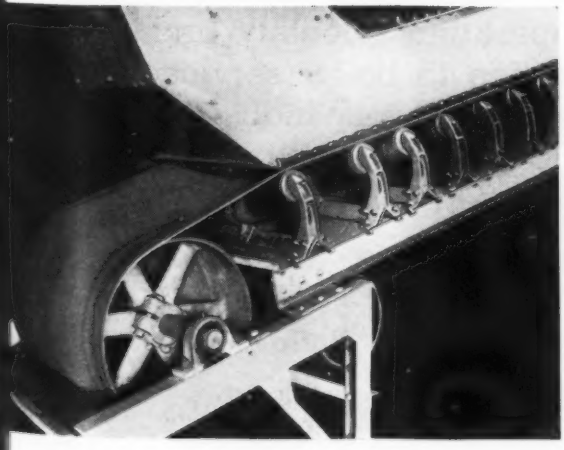
**Certificate Awards went to George Smolarek, Packard Motor Car Co.; Daniel Walter Mallett, Borg-Warner Corp.; Herbert Ruper James, National Tube Co.; and Stanley Crawford, RCA Manufacturing Co.**

**Men, you've done it! We're proud of you, and we are happy in the thought that you are receiving the public recognition you deserve. We hope your achievements will serve as stimulants to even greater employee participation in factory suggestion-box system, where more good ideas may be born and mature into helpful devices that will bring us an early peace.**

WOLVERINE TUBE DIVISION
OF CALUMET AND HECLA CONSOLIDATED COPPER COMPANY
Seamless COPPER • BRASS
1435 CENTRAL AVENUE • DETROIT, MICHIGAN

# COAL FOR THE FIRES OF VICTORY

## *Efficiently Handled by an S-A Conveyor Installation*



● The conversion of a power plant to coal often involves some questions of space, or handling, or storage or ash removal, which would *make or break the whole job.* The answer is: See S-A.

Stephens-Adamson has equipped and co-operated in the engineering of countless installations for unloading, conveying, storing and reclaiming coal—distributing it finally to the bunkers—all with minimum supervision, manpower and delay.

In the example illustrated here, one conveyor system elevates coal from boats or cars and distributes it to bunkers for immediate use, or diverts it by boom conveyor to a great storage pile. An additional tunnel conveyor system beneath the pile, draws on it to fill the bunkers as needed.

Today's conditions thoroughly prove how far-seeing such engineering was.

**STEPHENS-ADAMSON MFG. CO.**

**5 Ridgeway Avenue, Aurora, Illinois • Los Angeles, Calif. • Belleville, Ontario**

# STEPHEN S-A ADAMSON

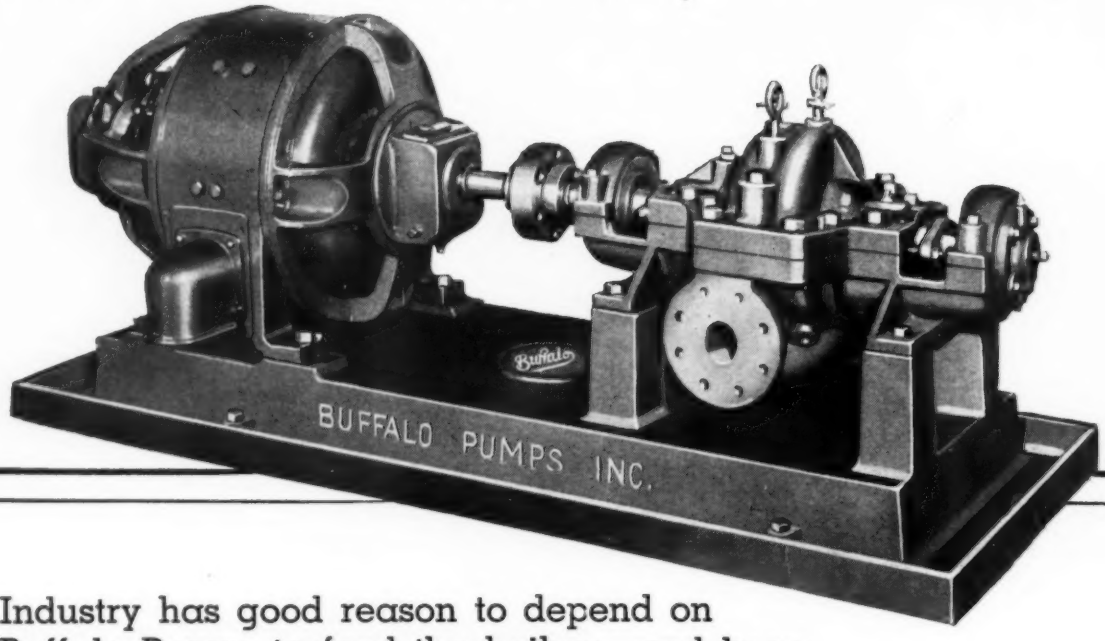
MFG. CO.

| | | | | |
|---|---|---|---|---|
| Chains and Sprockets | Belt Conveyors | | Bucket Elevators | Crushers |
| Bin Gates | Pan Conveyors | SealMaster | Feeders | Screens |
| Speed Reducers | Redler Conveyors | Ball Bearings | Skip-Hoists | Winches and Car Pullers |

**5 Ridgeway Avenue, Aurora, Illinois**

# "Buffalo" PUMPS

*keep boiler supply routes active*




Industry has good reason to depend on Buffalo Pumps to feed the boilers—and keep them supplied no matter how critical the demands. Backed by years of pump-building experience, Buffalo Boiler Feed Pumps are designed specifically for their job, operating smoothly and efficiently with low power input. In addition to boiler service, the Buffalo line includes pumps for practically every industrial application.

ARMY E NAVY

## BUFFALO PUMPS, INC.

488 Broadway — Buffalo, N. Y.

Branch Engineering Offices in Principal Cities
Canada Pumps, Ltd., Kitchener, Ont.

★ "Buffalo" PUMPS ★

# To Our Customers and Friends:

"Megger" Testers are, as you can well imagine, in unusually heavy demand during these strenuous days. Now, if ever, electrical equipment *must not fail*.

Although the demand has been for a quantity of instruments many times larger than our normal pre-war volume, we have so far been able to fill most high priority orders on schedule. Ours is the unique responsibility of supplying America's electrical men who must maintain electrical equipment on land, on the seas and in the air—with a testing device that is a vital necessity.

To this end we are now concentrating on the building of the more generally used types of "Megger" instruments in our Philadelphia factory We have complete manufacturing facilities, a loyal group of skilled men and women, and above all the *determination* to see that you get all the "Megger" Testers you need—at the earliest possible date.

**JAMES G. BIDDLE CO.**
**January, 1943**

P.S.—*We urge you to inform us as soon as possible of your requirements for "Megger" instruments, so that we can plan our production to meet your needs.*

**"MEGGER"**

TRADE MARK REGISTERED U.S. PAT. OFF.

**INSULATION TESTERS · GROUND TESTERS · OHMMETERS**

**JAMES G. BIDDLE COMPANY · 1211-13 ARCH STREET · PHILADELPHIA, PENNA.**

# YOU CAN BANK ON FAIRBANKS

FIG. 0601
Bronze Check

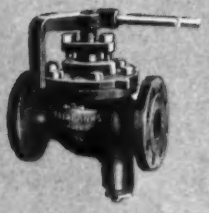


FIG. 0851
Ball-Plug Type

FIG. 0250
Bronze Gate

FIG. 0702
Iron Body Check

FIG. U-01
Bronze Globe,
Union Bonnet

FIG. 0501-P
Bronze Regrinding
Globe

FIG. 0405
Iron Body Gate

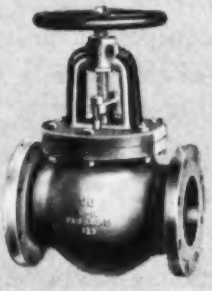
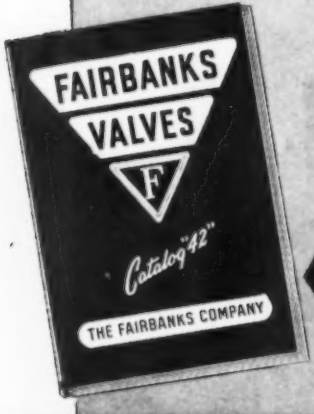


FIG. 0102
Iron Body Globe

FIG. 0418
U-Bolt
All-Iron Gate




**In these days of critical materials, when conservation of copper is needed for the war program, it is good business to use Fairbanks Renewable Valves. For, instead of being useless when worn, they can be easily renewed or the seat and disc reground–further extending the useful life of the valve.**

**You can bank on Fairbanks Valves for efficient operation, low maintenance costs and long life. They're built to the high standards that have guided us for over 50 years.**

**Made in a variety of types for a large range of services.**

**Write for Catalog 42 Covering Complete Line**

## THE FAIRBANKS COMPANY

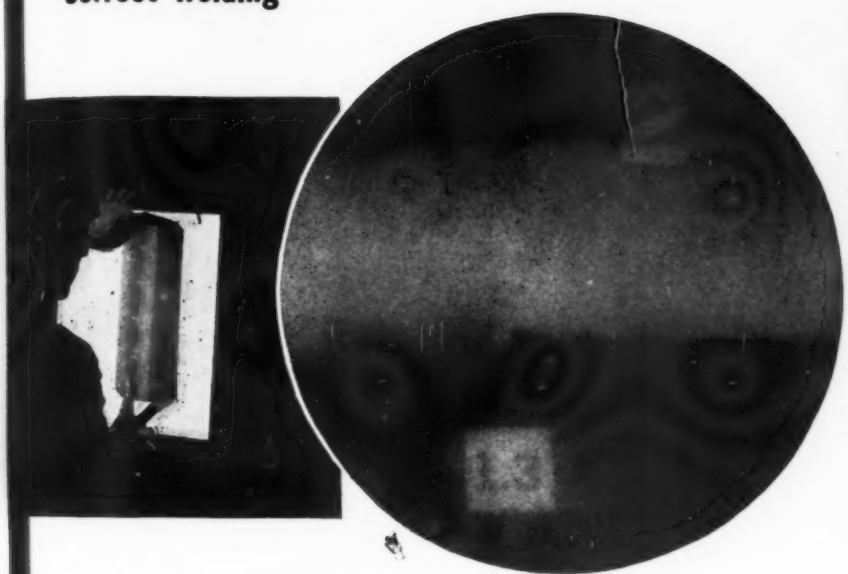
**397 Lafayette St., New York, N. Y.**

**Boston, Mass., Pittsburgh, Pa.**

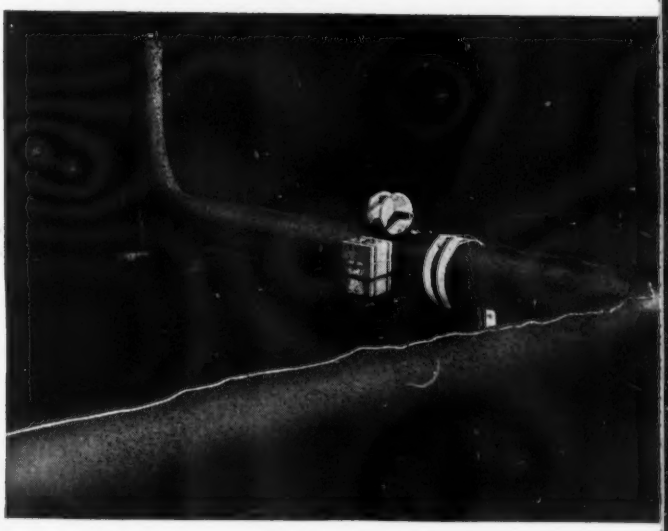
# Fairbanks *Standard and* Renewable Valves

# PROMOTING *Greater Safety* IN HIGH PRESSURE, HIGH TEMPERATURE PIPING

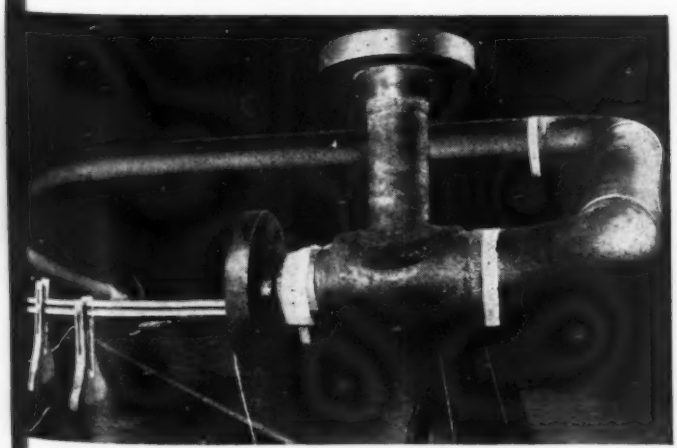
## *Gamma Ray* Inspection of Welds at PITTSBURGH PIPING & EQUIPMENT CO. Provides Positive Proof of Correct Welding



Powerful Gamma Rays emanating from radium placed on the inside of the piping, pierce through the thick metal and expose a special photographic film wrapped around the outside of the weld being investigated. Any defects in the weld metal and adjoining area of the piping can be easily traced on either a negative or a positive print, as illustrated above.



The radium is contained in a silver capsule encased in duralumin which is placed in the center of the wooden fixture shown on top of the pipe. The fixture is pulled centrally through the pipe until it is transversely in-line with the weld, where the Gamma-Rays expose the negatives placed around the outside weld area.



Making a Gamma-Ray inspection of a flange weld. The white bands visible around two other welds contain identification numbers which show on the exposed film.

THE welding of high pressure, high temperature piping requires modern shop equipment, proper procedure and highly trained men.

Pittsburgh Piping and Equipment Company has carefully worked out the correct welding procedure for each kind of metal and has skilled welders who have proven their ability by specified code tests. Their workmanship is further checked by Gamma-Ray Radiography of all shop and field welds, when required by codes or customers' specifications. Radiography by means of radium provides the most practical method of non-destructive testing of pipe welds. At Pittsburgh Piping and Equipment Company, Radiography is used beyond the requirements of codes and specifications to periodically check the performance of welders, so as to further insure the maintenance of uniform, high quality piping fabrication.


PITTSBURGH PIPING & EQUIPMENT CO., 10 FORTY-THIRD ST., PITTSBURGH, PA.

Woolworth Building, New York · Occidental Building, Indianapolis · Peoples Gas Building, Chicago · Union Guardian Building, Detroit
Public Square Building, Cleveland · 10 High Street, Boston · 525 Market Street, San Francisco

# ENLISTED *for the* DURATION

5 Reasons Why

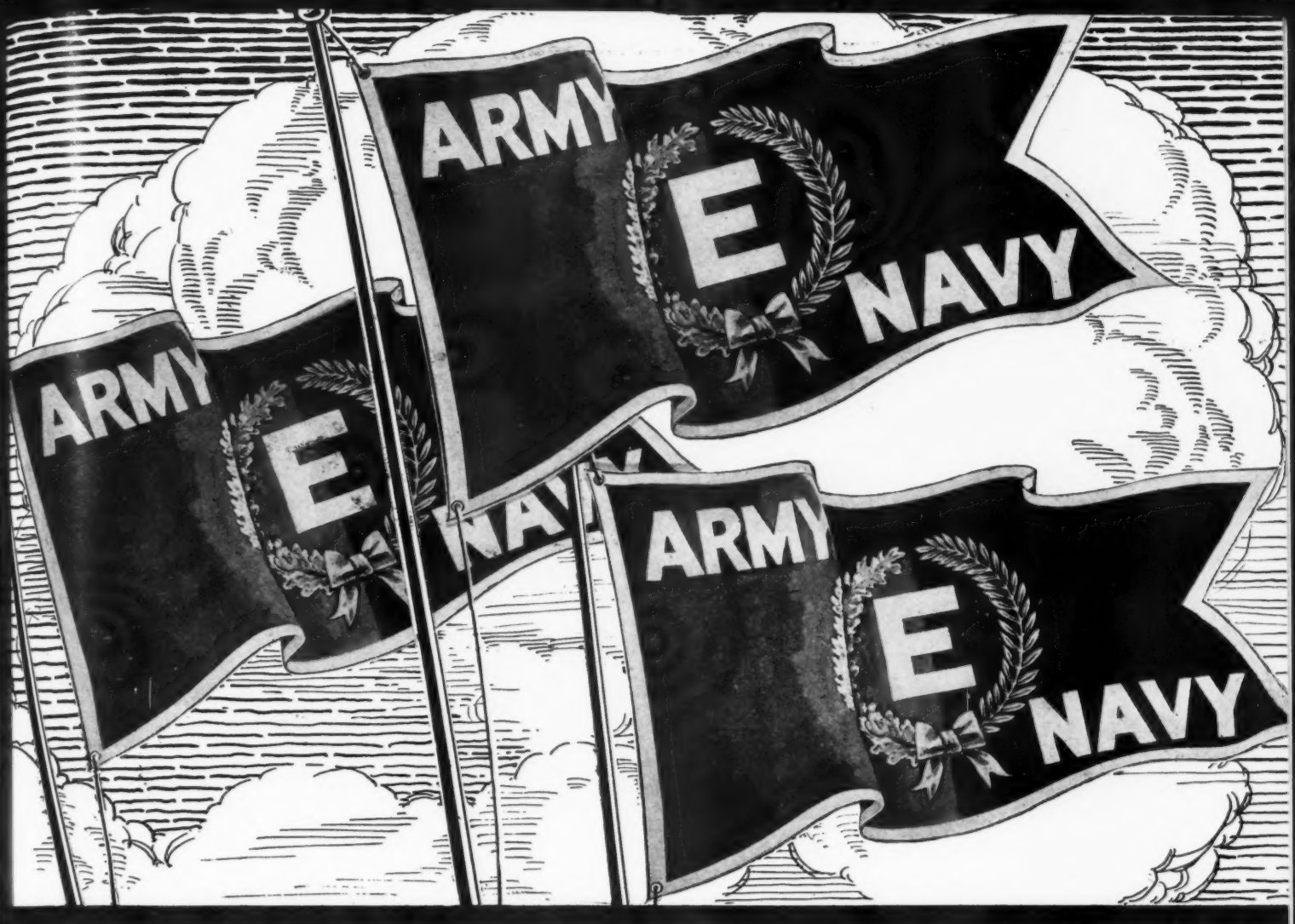
1 Easy to assemble, inspect and lubricate.
2 Occupy very little space.
3 Keep out dust, dirt and moisture; keep in lubricant.
4 Equipped with the exclusive SKF Triple Seal.
5 Replace plain bearings without the necessity of machining shafts.

WHEN the word flashed back that the Japs had attacked Pearl Harbor, thousands of SKF Pillow Blocks were guarding SKF Bearings against Friction on America's machines. Since then, thousands more SKF's have enlisted in the War Effort . . . defending bearings against lubricant leakage, dust, dirt and moisture . . . making sure the bearings give all they've got on the machines that keep Production UP . . . saving lubricant, time and man power in an all-out drive for Victory. Protect your bearings, and you protect machines that make the weapons that lick the enemy. SKF Industries, Inc., Phila., Pa.

4136

**SKF**

BALL & ROLLER BEARINGS
PILLOW BLOCKS




# THREE PENNANTS FLY IN RECOGNITION OF

## *"High Achievement in the Production of War Equipment"*

The employees of *all* Ingersoll-Rand plants won these Army-Navy "E" Awards for their high achievement in building equipment needed to win this war.

These men and women are turning out the Ingersoll-Rand machines urgently needed by our combat forces. They are also rushing through the I-R equipment that is vital for the production and operation of

Airplanes . . . Fighting and Cargo Ships . . . Tanks . . . Ammunition . . . Synthetic Rubber . . . Aviation Gasoline . . . Airfields, Bases, Roads and Bridges . . . Metal and Coal Mining . . . Railroads . . . Iron and Steel Mills . . . Machine Shops . . . Oil Production, Refining and Pipe Lines . . . Power Plants . . . Textiles . . . Foods . . . Process Industries . . .

COMPRESSORS
TURBO BLOWERS
CENTRIFUGAL PUMPS
ROCK DRILLS
AIR TOOLS
CONDENSERS
OIL AND GAS ENGINES

**Ingersoll-Rand**

14-237

11 BROADWAY, NEW YORK, N. Y.

# A Matter of Principle is Involved

. . . built into Morse Drives! Operating on the principle of TEETH NOT TENSION, Morse Drives eliminate the power waste . . . the slippage and frictional contact losses of power that sometimes occur when other drives are used.

Delivering power at practically 100% efficiency, every Morse Drive is a completely engineered power transmission unit so selected and designed as to render unfailing service under even the most adverse conditions.

Meeting the challenge of today's total war, Morse Drives are serving in tanks, planes, guns and ships . . . and in the factories, on the machines producing them . . . transmitting fractional h.p. in no-load timing devices, transmitting 5,000 h.p., and upwards, in steel mills.

Morse Drives will help you make important power savings, will help you speed production with their certain, positive action. Further, because Morse Drives are longer-lived, because they require a minimum of maintenance and service attention . . . they'll save you money.

*Your nearby Morse Drive Engineer will assist you in engineering Morse Drives to your job.*

SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS CLUTCHES

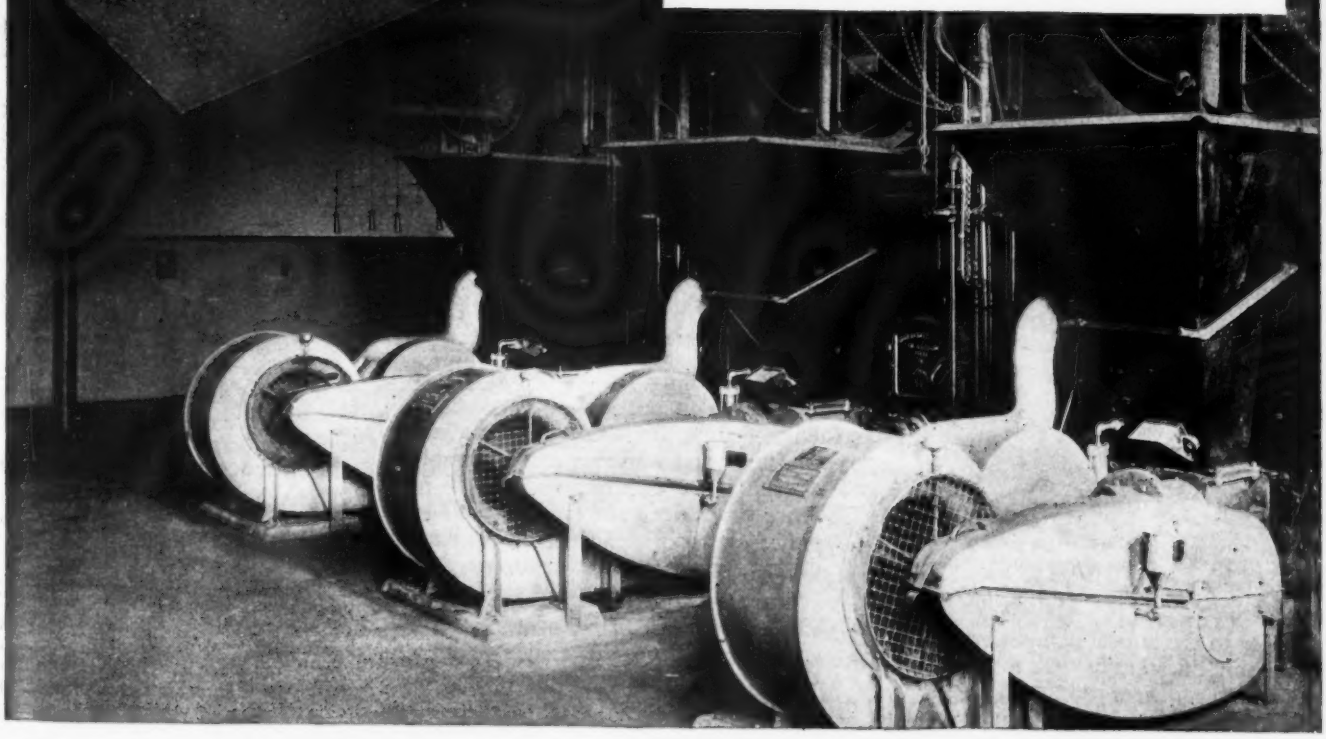
**MORSE *positive* DRIVES**

MORSE CHAIN COMPANY ITHACA N. Y. DIVISION BORG-WARNER CORP.

# Crystolon Brick FOR CONVERSION FROM OIL TO COAL

Many plants converting their boiler furnaces from oil to coal are requesting *Crystolon* (silicon carbide) brick—especially at the clinker line and bridge wall. *Crystolon* brick are made to "stand the gaff" at high temperatures, and their ruggedness makes them resistant to the abrasive action of ash and the motion of the fire bed. *Crystolon* brick are so dense as to prevent molten ash from taking hold by penetration and they resist the erosive action of slag. The use of *Crystolon* brick guarantees uninterrupted peak operation.

**NORTON COMPANY**
**Worcester** **Massachusetts**



**NORTON** ELECTRIC FURNACE FUSED **REFRACTORIES**

## WE CAN DELIVER THIS COOLING TOWER *QUICK!*

### *Okay—let's go!*

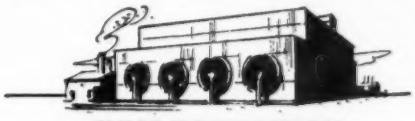
Key to the critical manpower situation is simplification of field tower erection which requires only unskilled labor. Tower erection is always under supervision of permanently employed Fluor Field Superintendents, who bring to your job many years of experience and all the necessary know-how. *Thus prefabrication solves another vital problem!*

THIS is a Fluor Atmospheric Aerator Cooling Tower. It requires no critical, hard-to-get equipment such as fans, gears and motors. It requires the fewest man-hours to build and completely eliminates the man-hours consumed in the production of unneeded auxiliary equipment. It requires the absolute minimum of critical materials. These are reasons why Fluor can deliver this kind of Cooling Tower—*quick!*

But another, equally important reason speeding delivery of Fluor Atmospheric Aerator Cooling Towers is 100% prefabrication in our plant—an *exclusive* Fluor feature. Important in peacetime, prefabrication is an even more desirable advantage in wartime. Because of it, Fluor has never once failed to deliver either ahead of schedule or on time during the Defense or War Program!

It means no delivery of raw lumber and no manufacturing operations on your premises with the attendant confusion and interference with your construction program or the normal conduct of your operations. Under Fluor prefabrication, the only work done on your property is actual erection accomplished in minimum time by a small crew.

Fluor Atmospheric Aerator Cooling Towers have established an enviable record for highest thermal efficiency in the service of some of America's foremost industrial organizations. They are the answer to the water cooling problems of industry today. Write for descriptive literature. *Be Sure With Fluor!*



**FLUOR MANUFACTURES MECHANICAL DRAFT COOLING TOWERS**

Under certain conditions Fluor can deliver Forced or Induced-type Mechanical Draft Cooling Towers. There must be a willingness on the part of customers to wait while submanufacturers deliver fans, gears and motors to our plant. They can be delivered only on the highest priority. That's why—for the duration—we recommend the Atmospheric type. In the meantime, Fluor continues with research and development of Mechanical Draft types to give you the advantage of many improvements when the war is over.

SINCE 1890

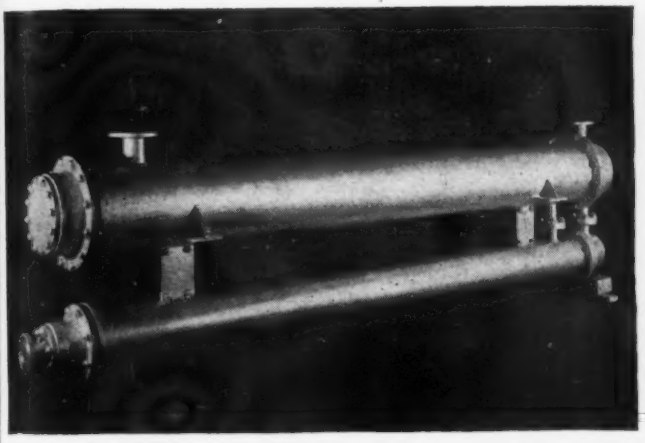
**THE FLUOR CORPORATION LTD.**
2500 SOUTH ATLANTIC BOULEVARD, LOS ANGELES, CALIFORNIA
NEW YORK • PITTSBURGH • KANSAS CITY • HOUSTON

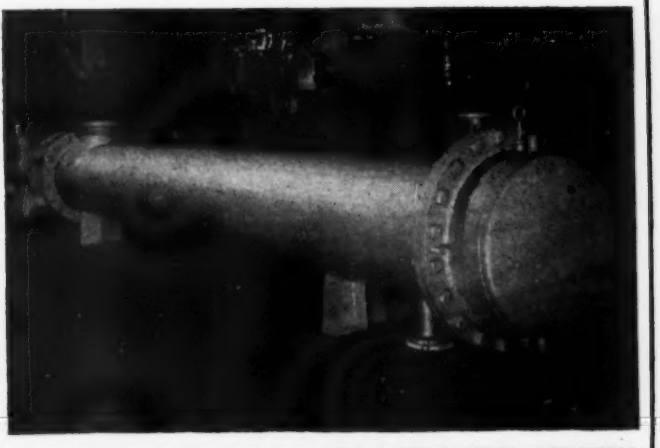
FLUOR

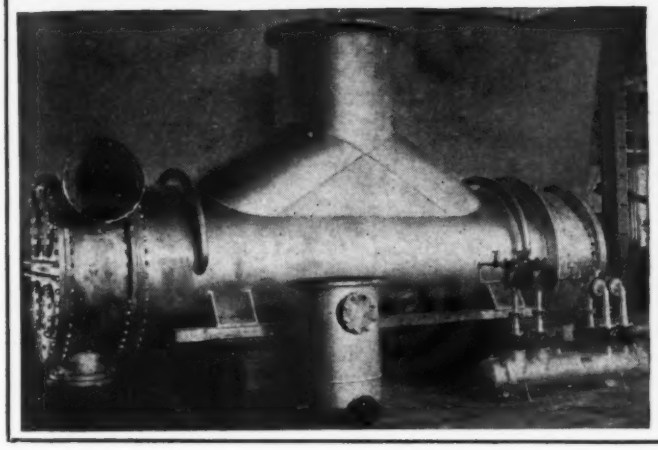
**ATMOSPHERIC AERATOR AND MECHANICAL DRAFT COOLING TOWERS**

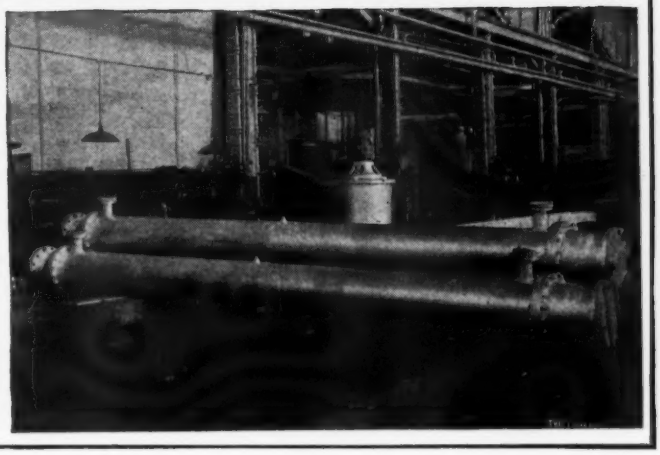
# HEAT INTERCHANGE AND VACUUM EQUIPMENT

## For Every Power Plant Need









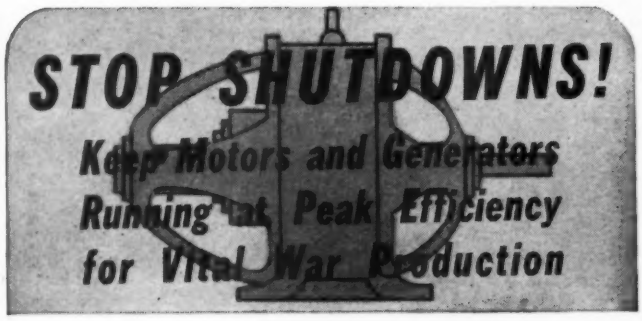
Long the country's largest single purchaser of heat transfer equipment for the refineries, etc., which it designed and built for leading companies, Lummus four years ago began building its own. It did this in order to make available to its clients improved equipment of modern design and superior workmanship.

The services of Lummus engineering personnel and the facilities of the Lummus heat exchanger plant at Honesdale, Pennsylvania, are available to public utilities and industrial plants for the study of specific problems and the design of heat exchanger equipment to meet individual conditions.

★ SURFACE CONDENSERS
★ STEAM JET AIR PUMPS
★ BLEEDER HEATERS
★ BOILER BLOWDOWN HEAT EXCHANGERS
★ FUEL OIL HEATERS
★ LUBRICATING OIL COOLERS

# LUMMUS

**THE LUMMUS COMPANY • 420 Lexington Avenue, New York, N. Y.**



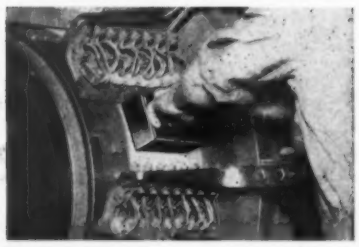

Running 24 hours daily—every day—is bound to raise havoc with all Motors or Generators, unless they are given periodic maintenance with - - -

## IDEAL Commutator Cleaning Stone

**Quickly Removes Excess Film**

A few seconds application periodically, cleans away excessive deposits of dirt or brush material caused by heavy and continuous power loads. Doesn't cut commutator; doesn't clog. Helps to seat brushes and increase brush life. 5 sizes.

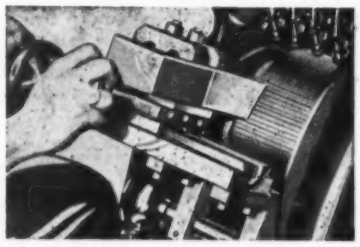
## IDEAL Resurfacers



**Keep Motors On the Job, WITHOUT DISMANTLING**

Quick, easy way to periodically smooth up Commutator and Slip Rings. Eliminates ridges, grooves, pits, high mica. Refinish to a smooth, highly polished surface. No dismantling; no production delays. Over 175 styles and sizes.

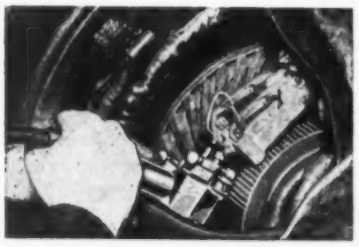
## IDEAL Precision Grinders



**True Up Commutators and Slip Rings In Own Bearings**

If Commutators and Slip Rings are badly grooved, scored, or out of round, this is the easy way to restore to original efficiency, WITHOUT DISMANTLING. Mount directly on motor frame; grinding is done at normal operating speeds. 3 models.

## IDEAL Mica Undercutters



**For Undercutting High Mica**

Three Models: (1) "Direct Drive", for small commutators. (2) "Universal", for small and medium size commutators. (3) "Shop Model", for large commutators.

*Write for Literature on Complete Motor Maintenance Line*

**IDEAL COMMUTATOR DRESSER CO.**
1025 Park Avenue Sycamore, Ill.
SALES OFFICES IN ALL PRINCIPAL CITIES
*In Canada:* Irving Smith, Ltd. Montreal, Quebec

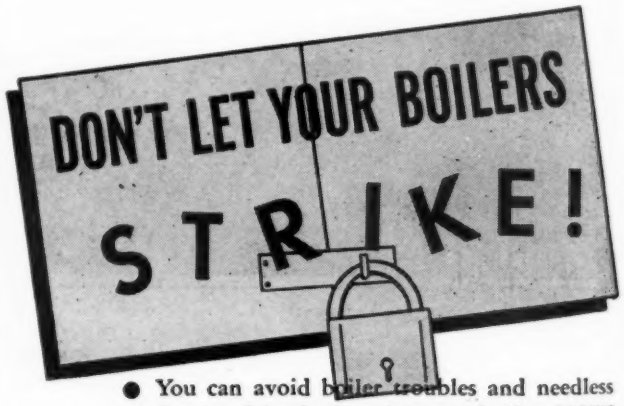
## USE THE GENUINE Squires REDUCING VALVES

for dead-end service, or wherever close regulation is required.

Also Steam and Air Traps, Pump Governors and Boiler Feed Water Controllers.

**THE C. E. SQUIRES CO.**
E. 40th St. and Kelley Ave., Cleveland, O.

## DON'T LET YOUR BOILERS STRIKE!



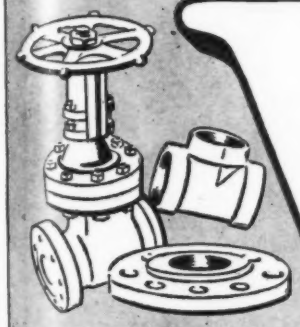
● You can avoid boiler troubles and needless production delay by insuring your boilers NOW against scale, corrosion and related troubles. Just call in the Ecco Engineer, a qualified service engineer of the Electric Chemical Co. He will analyze your difficulties and recommend the solution at no cost or obligation to you.

The nation-wide facilities of the Electric Chemical Company are ready to help you solve your particular problem. Use them and avoid needless boiler troubles.

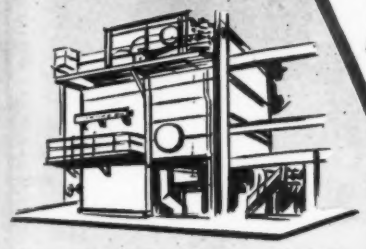
ECCO CATALYZERS FOR WATER CONDITIONING

**ELECTRIC CHEMICAL CO.**
8001 FRANKLIN AVE. • CLEVELAND, OHIO

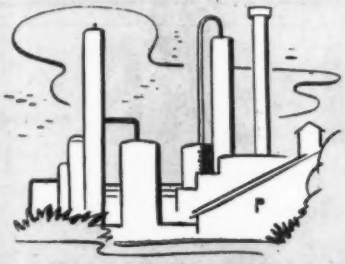
# WAR PRODUCTION COMES *FIRST!* . . . —



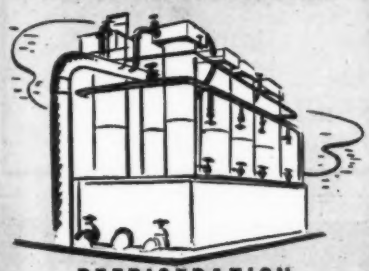
DROP FORGED STEEL VALVES, FITTINGS AND FLANGES



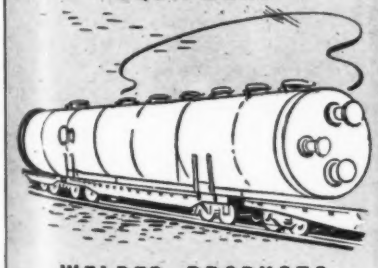
WATER TUBE BOILERS



OIL REFINERY AND CHEMICAL PLANT EQUIPMENT

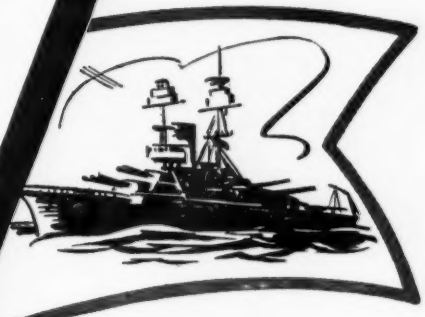


REFRIGERATION EQUIPMENT

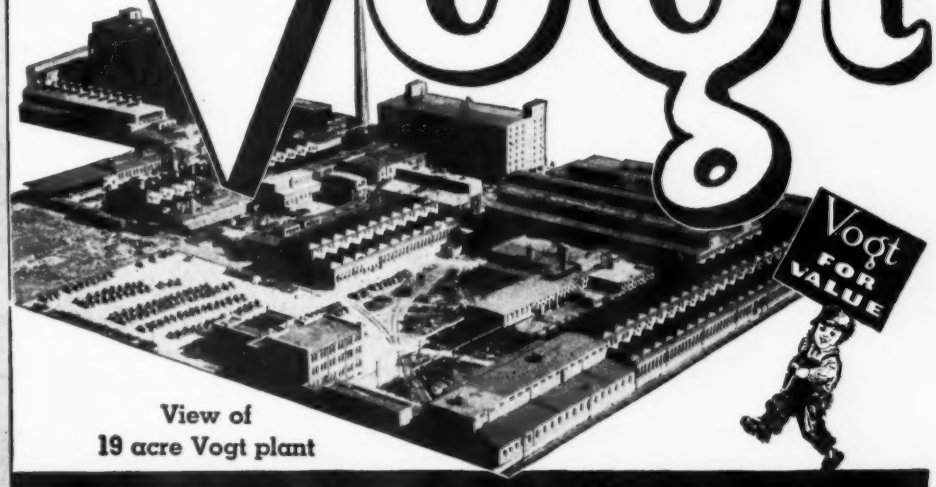


WELDED PRODUCTS

V "for Victory"



Vogt




View of 19 acre Vogt plant

**HENRY VOGT MACHINE CO., INC.**

LOUISVILLE, KENTUCKY

NEW YORK • CHICAGO • CLEVELAND • PHILADELPHIA • DALLAS

At Vogt's the production of essential equipment for VICTORY comes FIRST and is reaching new highs every week.

No effort is spared to deliver the goods on time and to maintain the quality of products necessary to the success of the war program.

# REMOTE CONTROL

*Sperry's*

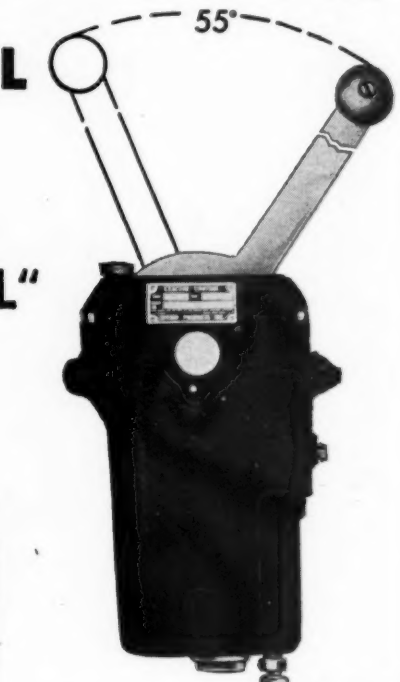
## HYDRAULIC "EXACTOR CONTROL"

assures
the smallest movement being
transmitted over long distances
**without backlash**
Installation simple, quick, economical

For use in Aviation, Marine & Industrial fields

RECEIVER

**SINGLE TUBE REPLACES:**
Cables, Turnbuckles
Pulleys, Bellcranks
Push Rods, etc.




TRANSMITTER

Standard on U. S. Army Air Corps Test Stands

**SPERRY PRODUCTS, INC.**
Hoboken, N. J.

# BROWNELL BOILERS

THE BROWNELL COMPANY
The World Over
DAYTON, OHIO, U.S.A.

**For 85 years this company has been making good boilers. We invite comparison on quality, price, and delivery of various types and sizes of fire tube boilers from 3 H. P. to 250 H. P.**

***Write us for illustrated bulletins.***

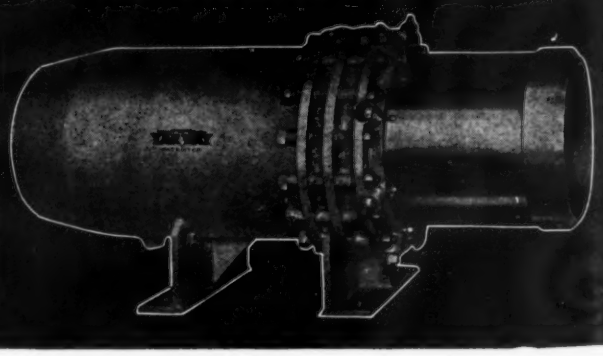
# YARWAY GUN-PAKT EXPANSION JOINT

It is packed under full steam pressure. By the turn of a wrench, integral pressure guns force a special semi-plastic packing into the stuffing box.

Welded Steel Construction. Alemite lubricated cylinder-guided sleeve. Made also in conventional gland-pakt types. Write for Bulletin EJ-1908.

•

**YARNALL-WARING COMPANY**
100 Mermaid Ave. PHILADELPHIA



# FOR VICTORY TODAY
# AND SOUND BUSINESS TOMORROW

## *Get This Flag Flying Now!*

This War Savings Flag which flies today over companies, large and small, all across the land means *business.* It means, first, that 10% of the company's gross pay roll is being invested in War Bonds by the workers voluntarily.

It also means that the employees of all these companies are doing their part for Victory . . . by helping to buy the guns, tanks, and planes that America and her allies *must* have to win.

It means that billions of dollars are being diverted from "bidding" for the constantly shrinking stock of goods available, thus putting a brake on inflation. And it means that billions of dollars will be held in readiness for post-war readjustment.

Think what 10% of the national income, saved in War Bonds now, month after month, can buy when the war ends!

For Victory today . . . and prosperity *tomorrow,* keep the War Bond Pay-roll Savings Plan rolling in *your* firm. Get that flag flying now! Your State War Savings Staff Administrator will gladly explain how you may do so.

If your firm has not already installed the Payroll Savings Plan, *now is the time to do so.* For full details, plus samples of result-getting literature and promotional helps, write or wire: War Savings Staff, Section F, Treasury Department, 709 Twelfth Street NW., Washington, D. C.

EVERYBODY EVERY PAYDAY AT LEAST 10%

Save With

**War Savings Bonds**

This Space Is a Contribution to America's All-Out War Program by

POWER

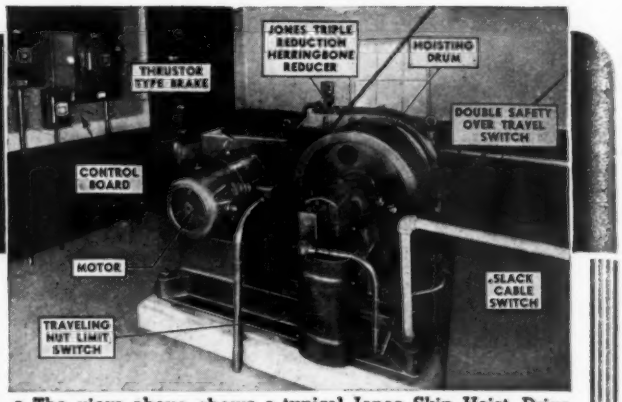
*For Economical Material Handling*

# JONES SKIP HOIST DRIVES

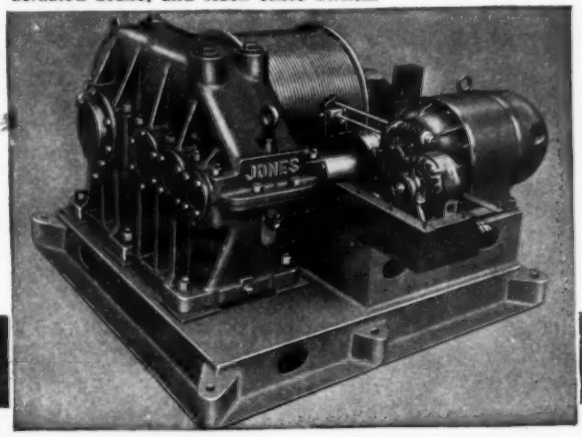
FOR speedy operation, reliable service and over-all economy the Jones Skip Hoist Drive has made a name for itself in a wide variety of material handling service. These skip hoist drives are built as complete units by the Jones organization in several types with base to take any motor specified by the purchaser. They are equipped for all the modern protective devices such as cam or nut type limit switches, solenoid or disc type brakes and slack cable switches. The drives are single, double, or triple reduction Jones Herringbone Speed Reducers, built to stand up under the many years of pounding that a skip hoist drive has to take. The shafts are supported in roller bearings, with rolling action, rack generated gear and pinion teeth to insure easiest possible starting with low starting-peak loads. All reducer bearings and gears are automatic oil-bath lubricated.

The Jones organization has an extensive file of information on skip hoist drive problems and will be pleased to work with you on any problems involving such applications

**W. A. JONES FOUNDRY & MACHINE CO.**
4423 Roosevelt Road, Chicago, Illinois



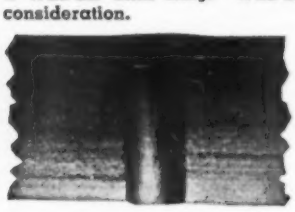

• The view above shows a typical Jones Skip Hoist Drive installation while the view below shows one of the Jones units equipped with traveling nut type limit switch, motor actuated brake, and slack cable switch.



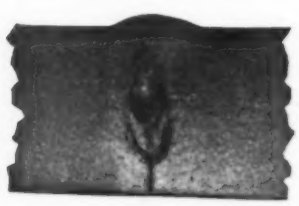

**Jones** HERRINGBONE—WORM—SPUR—GEAR SPEED REDUCERS
CUT AND MOLDED TOOTH GEARS • V-BELT SHEAVES
ANTI—FRICTION PILLOW BLOCKES • PULLEYS
FRICTION CLUTCHES • TRANSMISSION APPLIANCES

# *A NEW and BETTER way to WELD Pipe*
## • Use WEDGE *Split* CHILL RINGS

There is a new and higher standard of efficiency in WELDING PIPE. WEDGE Chill Rings, with the patented SPLIT Feature, are responsible. They assure 100% PENETRATION and STRONGER joints. Stronger joints prevent breaks that often cause serious damage. The unretouched photos show joints with and without a WEDGE Chill Ring. WEDGE Chill Rings deserve your serious consideration.



100% *penetration*



50% *penetration*

*Write for Circular and Prices*

**WEDGE PROTECTORS, INC.**
9524 Richmond Ave. Cleveland, Ohio

**WEDGE CHILL RINGS SAVE MONEY**

# *One or All of these Bulletins . . .*

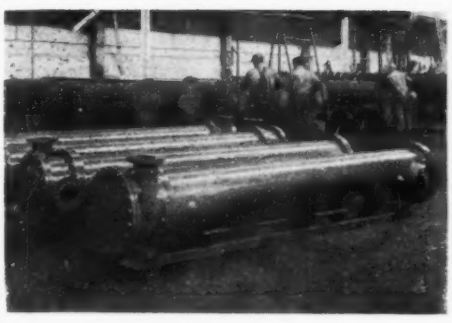
## . . MAY HELP YOU IN YOUR PROBLEM

True, most of our work at present is in War-Time activities. But there are no priorities on thinking and planning for peace. Water Refining Headquarters will be glad to answer your problems . . . and perhaps we can furnish some equipment now.

1. *Zeolite Water Softening*
2. *Corrective Chemical Feeders*
3. *Hot Process Water Softening*

**THE AMERICAN WATER SOFTENER COMPANY**
322 LEHIGH AVE., PHILADELPHIA, PA.

# Get the most from the TUBES you've got . . .



**RE-DESIGNING AND RECONDITIONING OF EXISTING CONDENSING AND HEAT EXCHANGE EQUIPMENT**

Putting to work our knowledge of the causes of service failures, we re-design existing units, whether in current use or considered obsolescent, and recondition and repair these condensers and heat exchangers to bring them up to modern performance. Specialized cleaning, repair and re-tubing equipment, plus the skills developed through our years of "hurry-up" production of completely reconditioned units during short power plant shut-down periods, are your assurance of satisfaction.

**SHOCK-TEST TO SAVE GOOD TUBES**

The hydro-dynamic Shock-Test, now in use for more than ten years, locates and destroys tubes just ready to fail. Shock-testing eliminates service leaks and keeps only good tubes in service. Frequently, less than ten per cent of the tubes in large condensers require replacement, but only by shock-testing can you *know* good tubes from bad.

## *Air and Erosion Eliminators*

Air and Erosion Eliminators are removable screen plates, installed at the inlet end of steam condensers and fitted with air ejection piping, to remove air from circulating water before it attacks tube sheets and tube ends. Eliminators stop electrolytic destruction of tubes and sheets and increase tube life from three to seven times in the average installation. Formerly an economy, today Air and Erosion Eliminators are essential to continuous operation.

## *Stretch Worn Tubes*

Don't scrap a tube because the ends are worn through. Let us shock-test used tubes to eliminate every tube incapable of further service and then stretch the usable tubes, cut off the bad ends and return the good tubes to service.

## *FLOWRITES prevent failures*

FLOWRITES — replaceable sleeves to take tube-end wear and save long tubes—prevent further destruction if tube ends show wear, or, installed in new tubes, keep them intact from wear. The bell-mouthed FLOWRITE provides *smooth* flow of circulating water and the fine taper insures *directed* flow past the tube end, preventing liberation of gases and consequent erosion. FLOWRITES are furnished in sizes to fit standard condenser and heat exchanger tubes, are easy to install and easy to replace.

## *"WIZARD" INJECTORS stop leaks immediately!*

No operator has ever been able to predict *which* condenser tube will develop the next leak or *when* tubes will leak. A "Wizard" Injector stops leaks when they start. No shut down. No contamination of feed. A handful of "Wizard" sealing compound in the funnel of a "Wizard" Injector is your protection against leaks. You open valves to an injection pipe and a steam line, inject the compound and stop the average tube leak within seconds of its detection.

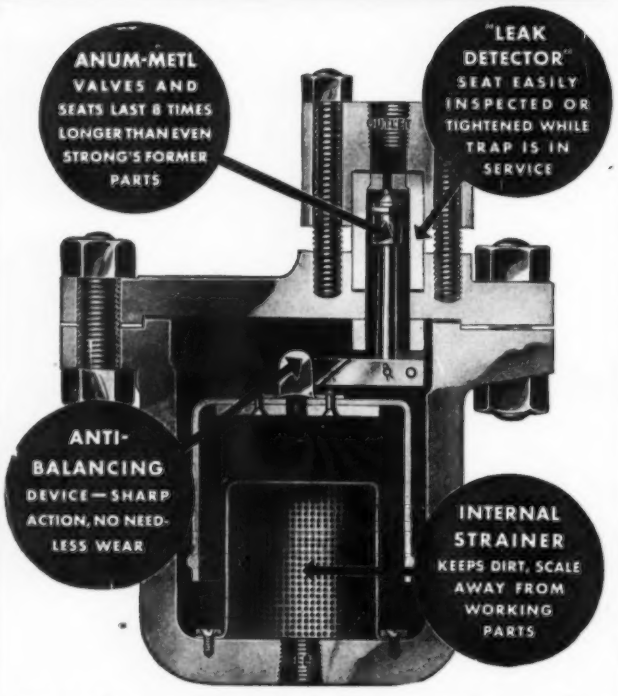
# "CONDENSER SERVICE"

**CONDENSER SERVICE & ENGINEERING CO., INC.**

**SEABOARD BANK BUILDING — HOBOKEN, NEW JERSEY**

PIPEWRENCH PETE SAYS:

WHEN YOU'RE HANDLING SUPERHEAT, GET ALL 4!


ANUM-METL VALVES AND SEATS LAST 8 TIMES LONGER THAN EVEN STRONG'S FORMER PARTS
"LEAK DETECTOR" SEAT EASILY INSPECTED OR TIGHTENED WHILE TRAP IS IN SERVICE
ANTI-BALANCING DEVICE—SHARP ACTION, NO NEEDLESS WEAR
INTERNAL STRAINER KEEPS DIRT, SCALE AWAY FROM WORKING PARTS

## 97% PERFECT TRAPS WASTE BIG MONEY!

High pressure traps better close tight or 300 to 1,400 pounds builds up waste fast! Worst part is, leaks may not be discovered for weeks!

Play safe with STRONG Forged Steel Traps whose 4 unusual features insure 100% *performance*. With these features, plus stainless buckets and wear-proof parts, they cost little to maintain in the perfect condition you need.

No wonder so many of the new high pressure plants specify STRONG Forged Steel Traps! They're a real buy. Investigate them, and STRONG'S *complete line* of steam specialties. Every item offers money-saving advantages! Send for Catalog 63-P3.

**MODERATE-PRICED REDUCING VALVE**

For initial pressures to 160 lbs., reduced to 85 lbs. or less, use STRONG Type K Reducing Valves. Trouble-free design. Anum-metl seats and discs guaranteed one year! Get bulletin 154-P3.

The Strong, Carlisle & Hammond Company
1392 West Third Street Cleveland, Ohio

3

# STRONG
STEAM SPECIALTIES

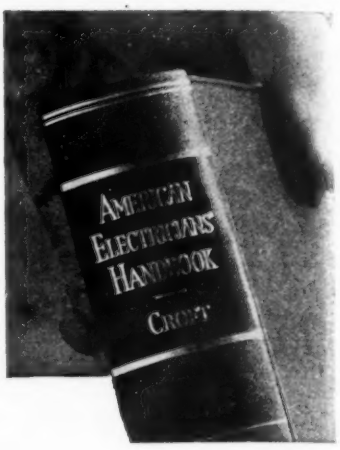


## *Get the right answer fast . . .*

**for more efficient profitable handling of**

**every type of practical electrical job**

Tens of thousands of men have used previous editions of this famous handbook with satisfaction, as a working guide of everyday usefulness. Now it is ready to help you too, in a big new 5th edition—600 pages larger than before — brought up to date in every respect — more than ever before the one great pocketbook of practical electricity for you.




***Enlarged 5th Edition***
**Terrell Croft's**

# AMERICAN ELECTRICIANS' HANDBOOK

This book is packed from cover to cover with the facts which every man engaged in electrical work needs to have constantly at hand. It gives the information you need in the form in which you can use it. From clear explanation of the fundamentals of electricity to suggestions for remedying the troubles of electrical equipment, the information is the kind that helps practical electrical men—wire men, contractors, linemen, plant superintendents, operators, construction engineers, and others—to select and install commercial electrical apparatus and materials intelligently for the performance of specific services. It gives the kind of data that will help them operate electrical equipment efficiently and to maintain it at high operating efficiency.

**Revised by**
**CLIFFORD C. CARR**
Head of Electrical Engineering Department, Pratt Institute

**1600 pages of**

*practical data, helpful pointers, explanatory illustrations and diagrams, useful rules, recommendations, and short cuts, and much descriptive information on modern electrical practice. 5x7½, 1177 illustrations, price only*

**$5.00**

## *10 big sections give you:*

—information on all commonly employed electric wires and cables; help in selection of proper type, methods of handling, etc.

—aid in selection and specification of switching, protective, capacitor, and wiring-device equipment, estimating space for switchboards, care of batteries, etc.

—practical data on operation, care, installation, and selection of motors and control equipment; information on planning motor circuits and drives.

—helps on transformers, outside distribution, luminaire equipment; handy wiring tables; etc., etc.

**10 DAYS' FREE TRIAL — SEND THIS COUPON TODAY**

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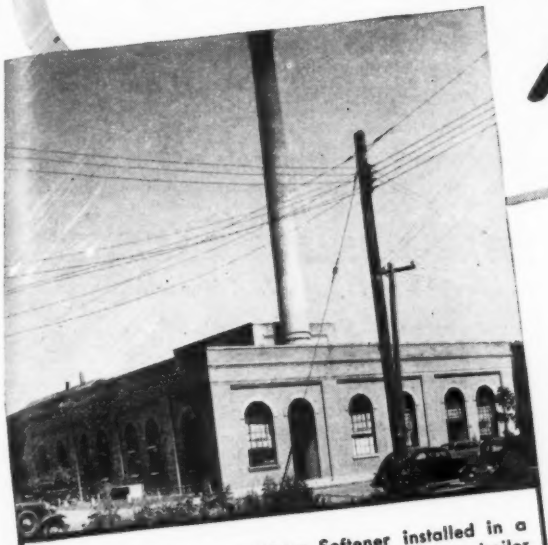
Send me Croft's American Electricians' Handbook for 10 days' examination on approval. In 10 days I will send $5.00, plus few cents postage, or return book postpaid. (Postage paid on cash orders; same return privilege.)

Name .....
Address .....
City and State .....
Position .....
Company .....P. 1-43

# No trace of scale or corrosion after *14 MONTHS USE!*



A Graver Hot Process Water Softener installed in a Minnesota Municipal Water and Light Plant softens boiler feed water for 1 Riley and 3 Kidwell 250 H. P. water tube boilers. Operating at 400 lbs. pressure they generate 300,000 lbs. of steam in summer and 500,000 lbs. in winter. Hardness of 11 to 22 grains is reduced to .4 of a grain.

UP IN MINNESOTA, a Municipal Water and Light Plant* installed a Graver Hot Process Water Softener to treat their boiler feed-water. Their boilers supply steam to drive the turbines which generate power for the city lights and steam to heat the business district of the town. And they are the source of power for the pumps which supply the city water.

The exacting demands on this boiler plant are continuous. Nevertheless, a thorough examination of the boilers after 14 months of use revealed that there was *no trace of scale or corrosion in the system.*

*Briefly, Here Are The Facts*

- Water supply tests 11 grains hardness in Summer and 22 grains in Winter.
- Graver Hot Process Water Softener reduces this to approximately .4 of a grain the year around.
- There is no trace of scale or corrosion.
- Water treating costs materially reduced.

This is just another example of the efficiency and economy of the Graver Hot Process Water Softener, and it is typical of the service this equipment is delivering in hundreds of plants all over the country.

If you have a specific water conditioning problem, consult Graver. There's no obligation.

*You'll Want This Bulletin*

Our new bulletin, No. 314, gives complete details about Graver Hot Process Water Softeners and includes flow charts, tables, and other valuable data. Write for your copy today.

**GRAVER TANK & MFG. CO., INC.**

4809-7 Tod Avenue, East Chicago, Ind.

NEW YORK CATASAUQUA, PA. CHICAGO TULSA

*Name on request*

**GRAVER HOT PROCESS WATER SOFTENERS**

43-2-W

# DO YOU WANT TO SEE THIS—HERE IN AMERICA?

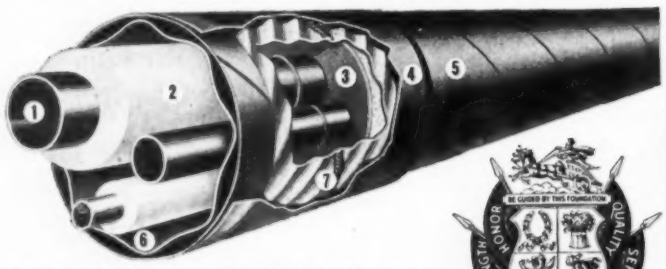
# —then WORK or FIGHT!

**OUR entire wartime program is designed to keep the war *away* from America. This plan, operating on far-flung battle lines, demands the utmost effort from every American. The command today is—work or fight!**

**In building up our vast system of men and armaments, Ric-wiL is proud to have a limited but vital part. To put more steam behind the war effort, steam supply lines themselves are needed, not by the foot but by the mile. Ric-wiL Insulated Pipe Units make available efficient steam pipe systems, for underground or overhead use, with a new kind of *speed*, because we do in the factory most of the work that formerly had to be done on the job.**

**For 33 years Ric-wiL has specialized in underground steam conduit. Now, for the Army, for the Navy, for war industry generally—Ric-wiL is working harder, in order that others may fight better.**

**For full information on complete Pre-Fabricated Insulated Pipe Units, as well as various other types of Ric-wiL Conduit Systems, write today for Catalog.**




1—Steam pipe
2—Sectional pipe covering
3—Pipe support
4—Thick strip asphalt applied after welding
5—Asbestos felt over asphalt coated Hel-Cor
6—Air space
7—Butt welded connection

**RIC-WIL** INSULATED PIPE UNITS FOR UNDERGROUND STEAM LINES
THE RIC-WIL CO., CLEVELAND, OHIO
*Agents in Principal Cities*

# Are you equipped to hold your job?—to get a new one?

**The men who are keeping their jobs today—who are not feeling the whip of competition—are those who have kept one jump ahead of their jobs. They are the men who are equipped with a thorough-going and growing knowledge of the business they are in.**

**It works in the power plant field as well as in any other. Some men fit themselves to do a little more than their job calls for. They fit themselves to do a little more than the other fellow. They make a steady effort to equip themselves with the best kind of job insurance there is—KNOWLEDGE.**

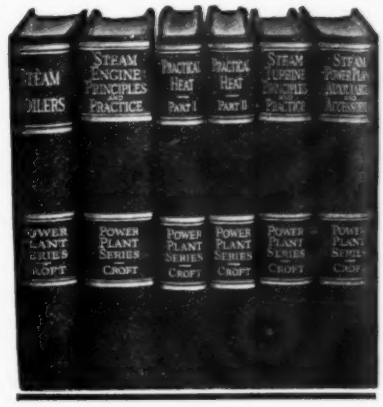
**How about you? Do you know how quickly knowledge will pile up—how quickly you will become more valuable—if you spend a few minutes a day, regularly studying sound books like the McGraw-Hill Library of Power Plant Practice? Do you know how easily it can be managed, paying only a few cents a day, while you use the books?**

**Thousands of men have followed this plan to win advancement or to make their jobs safe. You can too. Read about this Library and our Free Examination Offer. Then send the attached coupon to us today.**

## POWER PLANT PRACTICE

**(6 volumes—2,477 pages, 2,404 illustrations)**

The Library of Power Plant Practice is the standard of the power plant field. It is accurate — it is thorough — it is complete. It is the result of years of experience with power plant problems. The man who has it has the best. The Library covers the whole field—nothing is omitted. The solution of every problem is plainly worded or explained with a clear illustration. The little stickers and the big troublesome problems are all worked out in advance for you. There can be only one result from studying these books a few minutes each day — more money in your pocket.




No books dealing with the work of the power plant man were ever so complete — so authoritative — so practical in text and illustrations as these. The man who puts this set of books into his library can do so knowing that he has the utmost in power plant books—a set that will give him in language he can understand, all the information he needs in order to get ahead in his work.

## Easy to Understand

These books are written in everyday easy-to-understand language. They are written to help the man on the job. It is just as if the author were working in the plant by your side and giving you the benefit of his vast knowledge, man to man. There is no bunkum in this Library, nor is it cluttered up with impractical theories. It is a **Power Plant Library** FOR POWER PLANT MEN.

Glance at the titles of the books in the photograph. They will give you an idea of how completely this Library covers **Power Plant Practice.** Here you have all the information necessary to make you indispensable on the job.

## See it 10 days—Send no money

Fill in and mail the coupon below and we will send you the six volumes of the Power Plant Library for 10-days' examination. If you decide to keep the books after examining them, just send $2.00 and then $2.00 a month until the total low price of $16.00 has been paid. See the coupon below for details. Send it Now and HOLD THAT JOB!

**McGRAW-HILL FREE EXAMINATION COUPON**

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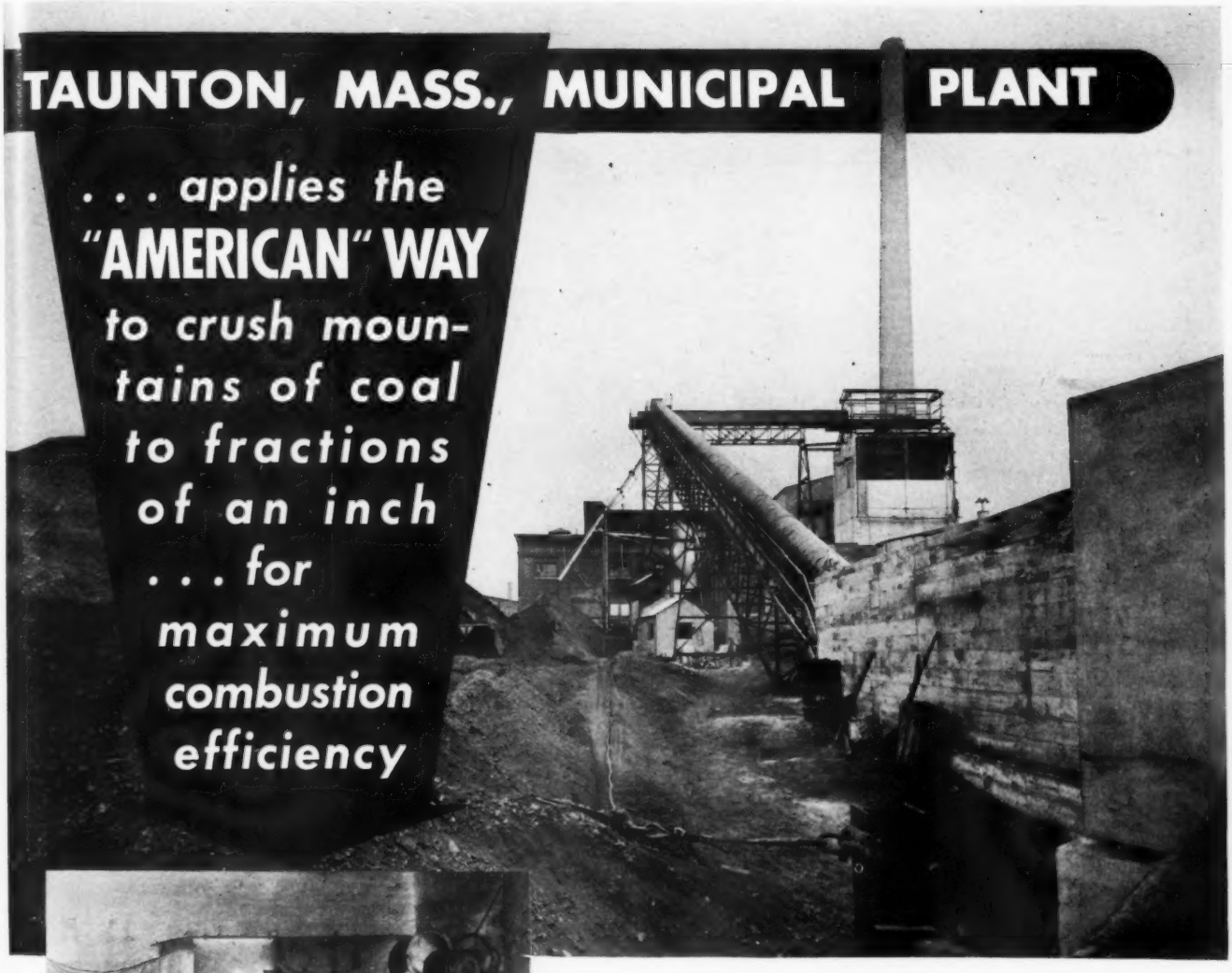
Position .....P. 1-43

# TAUNTON, MASS., MUNICIPAL PLANT

*. . . applies the*
**"AMERICAN" WAY**
*to crush mountains of coal to fractions of an inch . . . for maximum combustion efficiency*



## HOW THE "AMERICAN" ASSURES PROPER SIZING

Manganese steel shredder rings are an exclusive feature of the "AMERICAN" Crusher. These rings are designed in such a way that coal is split rather than crushed, thereby assuring exact sizing.

Proper coal preparation—for stoker or pulverized fuel firing—is an important consideration today as a means of getting the most out of every ton of coal you burn for power. Furthermore, proper coal preparation contributes to the realization of uninterrupted plant operation which is so necessary to meet the "all-out" demands for power.

Appreciation of the importance of these and other objectives led the engineers in charge of the Taunton, Mass. Municipal Power Plant to install an "American" Ring Crusher to size their coal. Some idea of the tonnage of coal handled by this "American" is obvious from the photograph of the coal storage and handling facilities shown here. The "AMERICAN" Ring Crusher—sturdy and designed for tough service—has ample capacity to meet the demands made upon it.

A check up on costs would undoubtedly show a crushing cost of less than a cent per ton which is an average figure for "AMERICANS" based on performance in many plants.

Now is the time for you to investigate the possibilities offered by "AMERICAN" Ring Crushers. Send at once for Bulletin "Crushing Coal at Less Than One Cent Per Ton." FREE ON REQUEST.

**AMERICAN PULVERIZER COMPANY**
ORIGINATORS AND MANUFACTURERS OF RING CRUSHERS AND PULVERIZERS
1349 MACKLIND AVE., ST. LOUIS, MISSOURI

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FOR WATER TUBES

***Less Fuel—More Power***

● For Water and Fire tubes. Rapid Vibration quickly breaks scale's grip on tubes. Special head on water tube type also breaks up scale. Fast work with moderate pressure—big fuel savings! Just try one. Also ask about the Mohawk Power Scraper.

**BRUNT EQUIPMENT CO.**
60 S. DIVISION ST. BUFFALO, N.Y.

**VOSS VALVES**

**INCREASED CAPACITY, SAVINGS IN POWER, SAFETY OF OPERATION**

***Made for all sizes of ammonia, air and gas compressors. Send for estimates, literature and references.***

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THE ORIGINAL
**Tripp Metallic Packing**
TRIPP METALLIC PACKING CO.
BOSTON MASS.

**A Good Habit**

This Where To Buy Section supplements other advertising in this issue with additional announcements of products and materials of special interest and application in the power generation and transmission field. Make a habit of checking this page each issue.

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*— Utility Engineering —*
Detecting wastes in Electricity, Gas, Fuel and Water, thus stopping losses, and frequently increasing production — nominal fee.
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R. E. HALL, Ph.D., Director
CONSULTANTS ON
BOILER WATER CONDITIONING
304 Ross St. Pittsburgh, Pa.

NO TIME TO EXPERIMENT . . .

So why not save time by calling in a specialist who knows the ground you are exploring?

POWER, meeting place of power men in all parts of the country, points the way to the solution of many power problems through its Professional Service Section.

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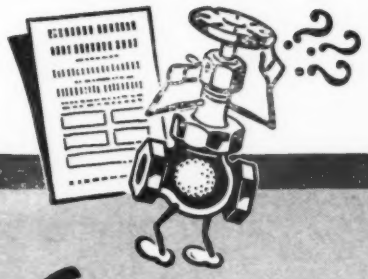
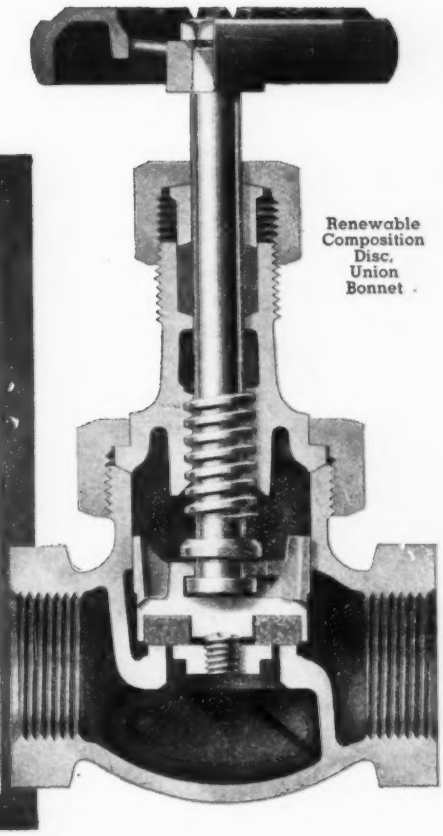


# An Occupational Questionnaire for GLOBE VALVES




**Today, when it is more important than ever before to keep pipe lines flowing at maximum efficiency, too much care cannot be given to selecting the right valve for each job. Before you "draft" a valve for that all-important line, make sure it is the type you really need. Here are some hints on GLOBE VALVE selection which may help.**

**WHEN SHOULD GLOBE VALVES BE USED?** Globe and angle valves are preferable to gate valves where the valve is to be operated frequently, because they open with fewer turns; and also where the valve is to be operated partially open, as on throttling service. They are not suitable where complete drainage of the pipe must be provided.

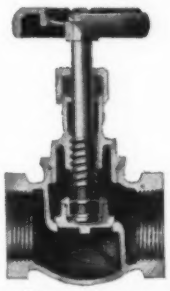
**WHAT ARE THE ADVANTAGES OF ANGLE VALVES?** Because of the basic similarity in operating mechanism, angle valves and globe valves are generally classed together. The use of angle valves saves an elbow and nipple and also reduces the pressure loss.

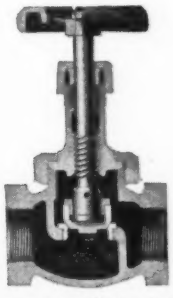
**WHEN SHOULD COMPOSITION DISCS BE SPECIFIED?** Globe and angle valves with composition discs are suitable for services other than high temperature. While these discs do not last as long as metal ones on throttling service, they increase the life of the seat by taking most of the wear of wire drawing, and are easier and cheaper to renew.

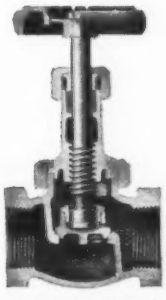
**FOR WHAT SERVICES ARE METAL DISCS PREFERABLE?** Metal discs in globe and angle valves last longer than composition discs on throttling and high temperature service.

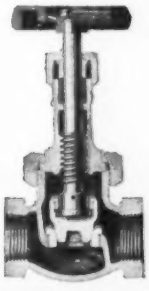
**WHEN SHOULD PLUG-TYPE DISCS BE USED?** Globe and angle valves with plug-type discs are the best valves for throttling service.

**WHAT ARE THE ADVANTAGES OF UNION BONNETS?** Union bonnets are desirable when valves may require frequent repair or replacement of disc. This type of connection minimizes the danger of distorting the body or bonnet when reassembling the valve after repairing.


Bronze Disc, Screwed Bonnet


Full-way Disc, Union Bonnet Renewable Seat Ring


Regrinding Disc, Union Bonnet


Plug-type Disc, Union Bonnet Renewable Seat Ring

*If you have a valve selection problem, write to us... we will be glad to make recommendations based on 65 years of experience building valves. And, you can be sure of receiving unbiased help, because Kennedy makes all kinds of standard gate, globe, angle and check valves. For full description of Kennedy valves, pipe fittings and fire hydrants, send for 240-page catalog.*

**KENNEDY** VALVES • PIPE FITTINGS • FIRE HYDRANTS
KENNEDY VALVE MFG. CO. • ELMIRA, N. Y.

# *The Aviation Industry* needs Seed Money

THIS Victory crop is sweet—10,000 planes per month next year seem certain . . . 5,000 per month already passed . . . Worldwide average of four enemy planes knocked down for every American plane lost . . . Jap average five to one . . . Still better planes coming off the line.

And beyond the war, some people see a vast new industrial field opening up for America:

▶ Giant freight and passenger airliners, flying the airocean to every part of the globe, linking our cities in a traffic network that will obliterate time.

Family planes that will jump golfers to far off greens.

What are the chances for this exciting post-war crop of commerce and convenient travel from our aviation industry?

We think the chances are rather slim, and we ask you to take a serious look at the reason.

In our proper anxiety to prevent inflation and control war profits, we have passed tax laws that are taking away most of the "seed money" that aviation companies will need when the time comes to go it on their own in the post-war world.

▶ "Seed money" is that part of profit which is held for re-investment in a business to insure its growth.

"Seed money" will pay for research on new and better products. It will pay for retooling when post-war models are produced. It will pay for the study of methods to get the lower costs that widen markets. It will pay for setting up new distributors and dealers, and for hundreds of other activities that are involved in the *growth* of a business.

▶ American industry has grown on "seed money." It has been a national characteristic to re-invest most of our profits in development.

A dangerous confusion between personal profit (salaries and dividends) and re-invested profit (which we have called "seed money") has found its way into our taxing system.

*The tax law, and government contracts, should allow American Industry to accumulate funds for the numerous tasks of post-war development.*

A sum greater than the total now remaining after taxes will be needed, if we are to take advantage of the new opportunities that will exist after the war.

It is probably the oldest law in economics that enough of each crop must be saved to provide seed for future crops.

Ask your Congressman to see that this economic law is not disregarded in an effort to take excess profits out of war.

***Reprints of this advertisement are available in handy booklet form.***

***McGRAW-HILL PUBLISHING COMPANY, Inc.***

**330 WEST 42ND STREET • • NEW YORK**

# Did you ever try to defend a PROFIT?

EVERY business man knows the difference between profit that is paid out to individuals and profit that is held for re-investment and future growth.

The trouble is that the public thinks of profit in terms of yachts, elaborate homes and costly debutante parties. They have learned to think that way because those things get the headlines.

The public does not know that far more profit money has gone back into American business than has ever been taken out for personal spending.

The McGraw-Hill Publishing Company is going to do its share in the job of explaining the difference between these two kinds of profit.

To be sure that the public does not confuse two different things that have always been called by the same name, we have developed the term "Seed Money."

"Seed Money" is explained in the McGraw-Hill newspaper advertisement reprinted on the opposite page. We urge you to read this advertisement carefully and apply its message.

There will be other McGraw-Hill advertisements on this vital industrial need. We hope, too, that other advertisers will adopt the term "Seed Money" and help by selling their employees in their own communities on the danger to living standards in taking away industry's ability to improve its plants and techniques.

* * *

**THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION**

23 publications, which gather "war-news" from the "war-production-front" through a staff of 153 editors and 725 engineer-correspondents... More than 1,500,000 executives, designers, production men and distributors use the editorial and advertising pages of these magazines to exchange ideas on war-production problems.

**THE McGRAW-HILL BOOKS**

Publishers of technical, engineering and business books for colleges, schools, and for business and industrial use.

**McGRAW-HILL PUBLISHING COMPANY, Inc.**
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Aviation—*(AMERICA'S OLDEST AERONAUTICAL MAGAZINE)—INFORMATION HEADQUARTERS FOR THE MEN WHO DESIGN, PRODUCE, OPERATE AND MAINTAIN AMERICA'S AIR SUPREMACY.*

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Bus Transportation
Business Week
Coal Age
Chemical & Metallurgical Engineering
Construction Methods
Electrical Contracting
Electrical Merchandising
Electrical West
Electrical World
Electronics
Engineering & Mining Journal
E. & M. J. Metal and Mineral Markets
Engineering News-Record
Food Industries
Factory Management and Maintenance
Mill Supplies
Power
Product Engineering
Textile World
Transit Journal
Wholesaler's Salesman

AFFILIATED WITH BUSINESS PUBLISHERS INTERNATIONAL CORPORATION, PUBLISHERS OF BUSINESS AND TECHNICAL MAGAZINES FOR LATIN AMERICA, AND OVERSEAS CIRCULATION.

Easy, instant die change. Just push the size selector buttons and turn the head slightly.

## TAKE GOOD CARE OF PIPE TOOLS TODAY

Keep them in good repair. Lubricate moving parts with a good grade of machine oil. Use a good grade of Sulphur Base Thread Cutting Oil. Keep the dies sharp. Above all do not abuse pipe tools today since metals are scarce and by prolonging their usefulness helps in the war effort. Save steel for victory—The Toledo Pipe Threading Machine Co., Toledo, Ohio—New York office, No. 2 Rector Street.

"TOLEDO"

MAKERS OF FINE

PIPE TOOLS, POWER PIPE MACHINES, VISES, BENCHES

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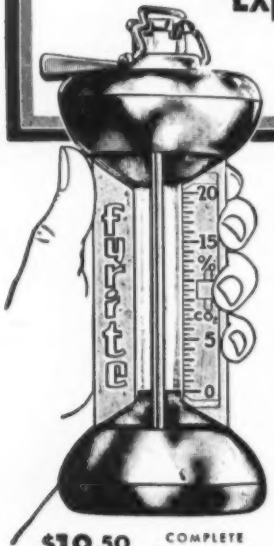
**FUEL is Vital for VICTORY**

**FYRITE $CO_2$ Readings Expose Fuel Waste INSTANTLY!**




The amazingly simplified FYRITE "Orsat" Analyzer makes accurate flue gas tests easy—instantly telling you what percentage of your fuel is being wasted. The FYRITE is conveniently held in the hand while analysis is taken. It is accurate within ½ of 1% $CO_2$; spillproof in any position; rugged, durable, compact. More than 7000 in use.

**RETURN COUPON BELOW.** *Obtain literature on Fyrite and learn how to get immediate delivery under priority regulations.*

$18.50 COMPLETE WITH INDUSTRIAL TYPE FLUE FILTER

**BACHARACH**
Industrial Instrument Co.
7000 BENNETT ST.
PITTSBURGH, PA.

SEND DATA ON *FYRITE "ORSAT"*

Name

Address

City State p

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for bringing business needs or "opportunities" to the attention of men associated in administrative, executive, management, sales and responsible technical, engineering and operating capacities with the industries served by McGraw-Hill publications:

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Bus Transportation
Business Week
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Coal Age
Construction Methods
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Electrical World
Electronics
Engineering News-Record
Engineering and Mining Journal
E & M J Markets
Factory Management and Maintenance
Food Industries
Power
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Textile World
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*For advertising rates or other information address the Departmental Staff*

McGRAW-HILL PUBLICATIONS
330 W. 42nd St., New York, N. Y.

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10 cents a word, minimum charge $2.00.
(See ¶ on Box Numbers.)
POSITIONS WANTED (full or part-time individual salaried employment only), ½ the above rates.
PROPOSALS, 50 cents a line an insertion.

**INFORMATION:**
BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.
DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

**DISPLAYED—RATE PER INCH:**
The advertising rate is $6.30 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches —to a page. P.

*NEW ADVERTISEMENTS received by January 12th will appear in the February issue, subject to limitations of space available.*


**GRASP This OPPORTUNITY!**

Closing your western New York office? Firm ideally set up to represent your interest. Offices in Buffalo, Syracuse and Rochester with warehouse in strategically located Buffalo. Sales Engineers and important contacts for Power, Transmission, Chemicals and allied products—

Manufacturers Representative for some of the largest companies in this field.

Write regarding accounts now serviced — Best references.

RA-344, Power
330 West 42nd St., New York City


### POSITION VACANT

WELL ESTABLISHED and modern instrument house wants sales and/or service engineers for Middle West and East. Technical education or similar experience important. Should be reasonably draft deferred. Salary and bonus. P-360, Power, 520 N. Michigan Ave., Chicago, Ill.

### POSITION WANTED

CHIEF ENGINEER—Centrifugal pumps. 22 years successful experience. Economical standardized design. Familiar all engineering and manufacturing phases. Many years in responsible supervisory positions. Eastern location preferred. PW-342, Power, 330 W. 42nd St., New York, N. Y.

### EMPLOYMENT SERVICE

SALARIED POSITIONS — $2,500 to $25,000. This advertisement service of 33 years' recognized standing negotiates for positions of calibre indicated. Procedure individualized to your personal requirements. Retaining fee protected by refund provision. Identity covered. If salary has been $2,500 or more send for details. R. W. Bixby, Inc., 270 Delward Bldg., Buffalo, N. Y.


**OPERATING ENGINEERS — WANTED**
**Operating engineers who have or have had a Marine Engineers' License. Wages from $300 to $700 per month.**

*Apply*
**Local No. 33, M. E. B. A.**
**227 Fulton Street New York City**

*SALESMEN WANTED*

THERE is an opening in a few selected territories for an experienced salesman who has successfully sold services or intangibles. Technical experience not necessary. An American Citizen between the ages of 35 and 55, preferably married, who is able to meet and contact key executives in industry. Field training will be given the successful applicant and earnings should be $4,000 a year—the average of our present salesmen. One acquainted with the field served by this publication will find this connection a pleasant and profitable one. Our organization is an old, well-known concern with an excellent reputation. To learn more about this opportunity write full details to

SW 346, Power
330 West 42nd St., New York City

WANTED

**—TRANSFORMERS—**

**TRANSFORMERS WANTED**

in operating condition or burnt out. Mail us list giving complete nameplate data and stating condition.

**We Rewind, Repair and Redesign all Makes and Sizes**
**ALL TRANSFORMERS GUARANTEED FOR ONE YEAR**
**We will be pleased to quote prices on request.**

**THE ELECTRIC SERVICE CO., INC.**
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI, OHIO

**MOTOR REWINDS?**
**ARE YOU PARTICULAR?**
**DO YOU HAVE A SPECIAL MOTOR?**
***We stock only the Best of Insulation***
**100% Factory Work**
**TRY US**

*Previous Experience with*
**General Electric Allis Chalmers**
**Westinghouse Navy Yard Work**

**C. V. HUNT**
Est. 1916
Ridgefield, N. J. Morsemere 6-5091
Trucks #1—U.S. Highway and Erie Railroad

**DIESEL ENGINES**
**WANTED**
1500 HP in one or more units with or without Generators. Single unit preferred. Give full information.

W-343, Power
330 West 42nd St., New York City

**Wanted for Government Project**

Water tube boilers combined minimum output 90,000 pounds steam per hour divided among 3 to 5 units, 160 pound working pressure. Submit complete specifications, condition, and present location. Units must be suitable for firing with hand fed stokers. Also interested in suitable stoker equipment.

**RALPH S. HERZOG**
**and HENRY W. HORST COMPANY**
*Naval Aviation Material Storehouses and Facilities*
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*** MECHANICAL ENGINEERING ***
Also furnishing power plants, industrial, municipal and private, plants, designed, appraised or built, complete or parts, steam or other fuels, boilers, engines, pumps, machine and manufacturing plants also, new or used equipment.
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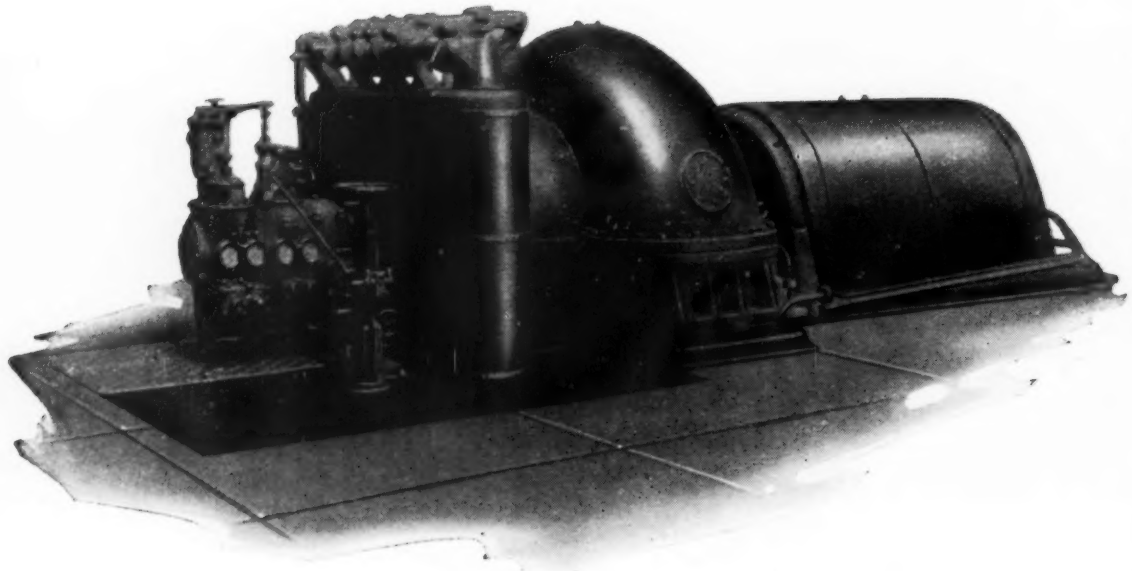
Oklahoma City, Oklahoma

# ELECTRICAL POWE



*Actual Photograph*

**3125 KVA GENERAL ELECTRIC CONDENSING TURBO UNIT**

*3125 KVA General Electric Alternating current generator, 3 phase 60 cycle 2400/4160 volts 3600 RPM direct connected to General Electric condensing turbine 225-400 lbs. steam pressure 700 deg. TT. Equipped with surface condenser and auxiliaries.*

**ALTERNATING CURRENT TURBO GENERATORS**

**3 Phase 60 Cycle**

9375 KVA GENERAL ELECTRIC condensing, 225 lbs. pressure, 100 deg. superheat, 1800 RPM with surface condenser: 4800 volts.

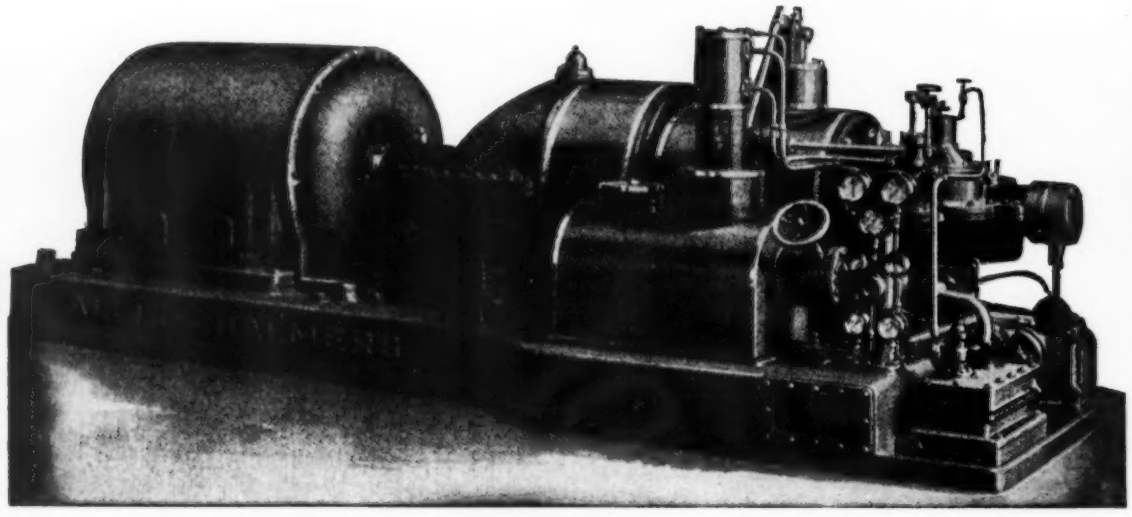
6250 KVA GENERAL ELECTRIC condensing, 220-225 lbs. pressure, 100 deg. superheat, 3600 RPM with jet condenser; 2300 volts.

3125 KVA GENERAL ELECTRIC condensing, 225-400 lbs. pressure, 700 deg. TT, 3600 RPM with surface condenser; 2300/4160 volts.

1250 KVA ALLIS CHALMERS condensing, 150-200 lbs. pressure, 100 deg. superheat, 3600 RPM with jet condenser; 2300 volts.

**SURFACE CONDENSER**

1540 sq. ft. WORTHINGTON surface condenser with steam jet air pumps.



*Actual Photograph*

**1250 KVA ALLIS CHALMERS CONDENSING TURBO UNIT**

*1250 KVA Allis Chalmers alternating current generator 3 phase 60 cycle 2300 volts 3600 RPM direct connected to Allis Chalmers condensing turbine 150-200 lbs. steam pressure 100 deg. superheat. Equipped with jet condenser and auxiliaries.*

**DIRECT CURRENT ENGINE GENERATORS**

**125/250 Volts 3-Wire**

150 KW CROCKER WHEELER—Ames 3 cylinder vertical Uniflow, 200-250 lbs. 0.8 lbs. back pressure, 360 RPM.

125 KW CROCKER WHEELER—Ames 3 cylinder vertical Uniflow, 200-250 lbs. 0.8 lbs. back pressure, 360 RPM.

**ALTERNATING CURRENT ENGINE GENERATORS**

**3 Phase 60 Cycle**

438 KVA GENERAL ELECTRIC - SKINNER uniflow, 125-150 lbs. steam pressure, 0-5 lbs. back pressure, 150 RPM; 2300-600-480-240 volts

210 KVA GENERAL ELECTRIC - SKINNER uniflow, 120-150 lbs. steam pressure 0-3 lbs. back pressure, 225 RPM; 2300-600-480-240 volts

210 KVA GENERAL ELECTRIC, 2300-600-480-240 volts, 225 RPM (GENERATOR ONLY)

# THE NATIONAL POWER

# WER EQUIPMENT

## ROTARY CONVERTERS

### 60 Cycle

3500 KW (2) WESTINGHOUSE, 225-285 volts D.C., 225 RPM with 3 phase 60 cycle 13200 volt transformers.

2500 KW WESTINGHOUSE, 600 volts D.C., 400 RPM with 3 phase 60 cycle 11000 volt transformers.

1500 KW WESTINGHOUSE, 225-285 volts D.C., 450 RPM with 3 phase 60 cycle 2300/4000-6900/12000 volt transformers.

1000 KW WESTINGHOUSE, 600 volts D.C. 900 RPM with 3 phase 60 cycle 4000 volt transformers

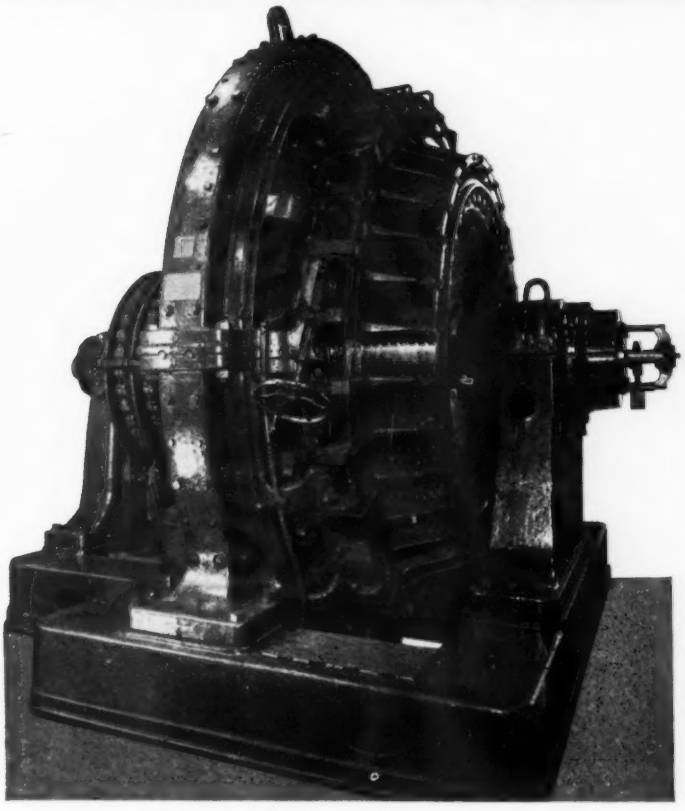
750 KW GENERAL ELECTRIC, 600 volts D.C., 1200 RPM with 3 phase 60 cycle 2300/4000 volt transformers.

500 KW (2) WESTINGHOUSE, 600 volts D.C., 1200 RPM with 3 phase 60 cycle 6600/2300-445/222 volt transformers.

## ROTARY CONVERTERS

### 25 Cycle

1500 KW WESTINGHOUSE,, 600 volts D.C., 500 RPM with 3 phase 25 cycle 11000 volt transformers.



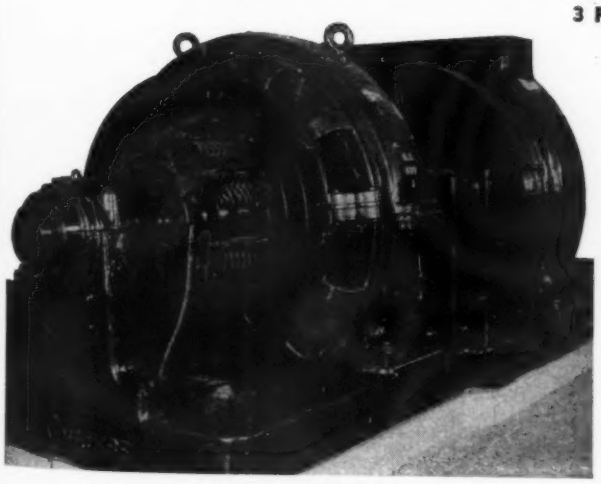
*3500 KW (2) Westinghouse booster type interpole, rotary converters, 225-285 volts D.C. 225 RPM; 6 phase 60 cycle A.C. with 3 phase 60 cycle 13,200 volt transformers. Complete with control.*

*Actual Photograph*

**3500 KW WESTINGHOUSE ROTARY CONVERTER**

## MOTOR GENERATOR SETS

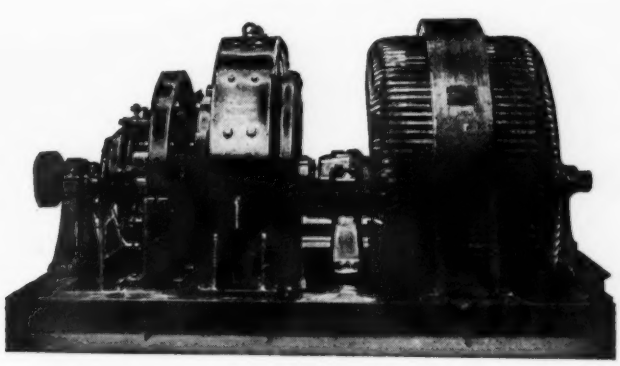
### 3 Phase 60 Cycle



*Actual Photograph*

**1000 KW WESTINGHOUSE MOTOR GENERATOR SET**

*1000 KW (1500 KW 2 hrs. 55 deg. C rise) WESTINGHOUSE direct current generator 125/250 volts 3-wire 720 RPM direct connected to 1427 HP 80% P.F. (2140 HP 2 hrs. 55 deg. C rise) WESTINGHOUSE synchronous motor 3 phase 60 cycle 2300 volts 720 RPM. Equipped with D.C. control panel and starting equipment.*



*Actual Photograph*

**1000 KW GENERAL ELECTRIC MOTOR GENERATOR SET**

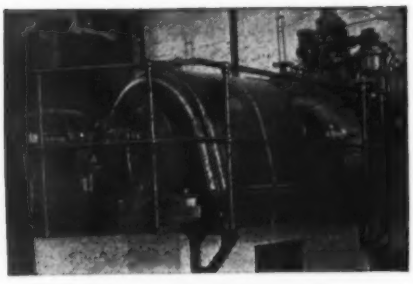
*1000 KW (1250 KW 2 hrs. 55 deg. C rises) GENERAL ELECTRIC direct current generator 125/250 volts 3-wire 720 RPM direct connected to 1400 HP 80% P.F. (1750 HP 2 hours 55 deg. C rise) GENERAL ELECTRIC synchronous motor 3 phase 60 cycle 13200/6600 volts 720 RPM. Equipped with D.C. breakers.*

R MACHINERY CO. 1921 SCRANTON RD. CLEVELAND, OHIO

# Bring on your "PRIORITIES"... bring on your INSPECTORS!

Hemphill

# "HEMPHILL" EQUIPMENT IS READY— welcomes your closest examination . .



### MOTORS GENERATOR SETS

1—75 KW, 125 volt, GE, sq. cg.
1—20 KW, 600 volt, GE, sq. cg.
1—15 KW, 250 volt, GE, sq. cg.

### D. C. GENERATORS

1—75 KW, 675 RPM, 125 volt, Westinghouse.
1—75 KW, 260 RPM, 250 volt, Westinghouse.
1—75 KW, 675 RPM, 125 volt, Westinghouse.

### MOTORS—3 PHASE 60 CYCLE

1—720 HP, 360 RPM, 440 volt, G.E., syn.
1—500 HP, 1200 RPM, 440 volt, GE, syn.
1—400 HP, 514 RPM, 440 volt, Westg., slip ring.
1—350 HP, 100 RPM, 220/440 volt, G.E. syn.
1—335 HP, 600 RPM, 2300 volt, G.E. syn.
1—300 HP, 720 RPM, 2200 volt, G.E., Sl Rg.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—250 HP, 600 RPM, 4000 volt, G.E. Sync.
1—200 HP, 900 RPM, 440 volt, Westg., sl. rg.
1—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
1—200 HP, 450 RPM 2200/4000 v., G.E., sl. rg.
1—150 HP, 1800 RPM, 2300 volt, Al. Ch. sq. cg.
1—150 HP, 1800 RPM, 440 volt, West. Sq. Cg.
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
1—150 HP, 720 RPM, 440 volt, G.E., slip ring.
1—150 HP, 600 RPM, 440 volt, G.E., slip ring.
1—150 HP, 400 RPM, 440 volt, G.E., sq. cg.
2—125 HP, 720 RPM, 440 volt, G.E., slip ring.
1—100 HP, 1800 RPM 440 volt, Westinghouse sq. cg.
1—100 HP, 900 RPM, 440, Westinghouse, sq. cg.
1—100 HP, 900 RPM, 440 volt, G.E., slip ring.
3—100 HP, 720 RPM, 440 volt, G.E., slip ring.
1—100 HP, 720 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 600 RPM, 440 volt, G. E., slip ring.
1—100 HP, 600 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 514 RPM., 440 volt G.E. sq. cg.
2—100 HP, 450 RPM, 440 volt, G.E., sq. cg.
1—90 HP, 400 RPM, 550 volt, Crocker Wheeler sq. cg.
1—75 HP, 900 RPM, 4000 volt, Elec. Mach. syn.
1—75 HP, 900 RPM, 220 volt, Fairbanks, Morse, slip ring.
1—75 HP, 900 RPM, 440 volt, GE, sq. cg.
1—75 HP, 720 RPM, 440 volt, Westghse, slip ring.
1—75 HP, 720 RPM, 440 volt, GE, sq. cg.
1—50 HP, 900 RPM, 440 volt, GE, slip ring.
1—50 HP, 900 RPM, 440 volt, GE, sq. cg.

### MOTORS—D. C. 230 VOLTS

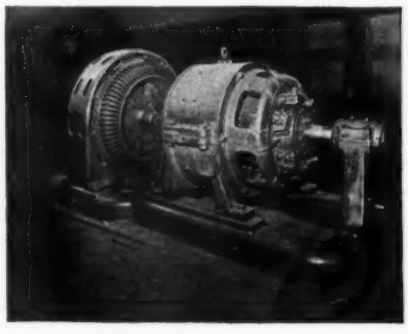
1—250 HP, 760 RPM, Electro Dynamic.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E. 575 RPM
1—100 HP, 625 RPM, G.E.
1—90 HP, 900 RPM, GE.
1—75 HP, 950 RPM, GE.
1—60 HP, 1000 RPM, G.E., type RC.
1—50 HP, 750 RPM, Westinghouse, type SK.
1—50 HP, 700 RPM, Crocker Wheeler.
1—40 HP, 775 RPM, Westinghouse.
1—40 HP, 300 RPM, General Electric
1—30 HP, 750 RPM, G.E., type RC.

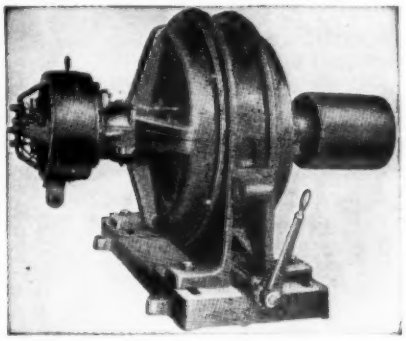
### MOTORS—VARIABLE SPEED 230 VOLTS

2—100 HP, 475/1375 RPM, Electro Dynamic
1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—60 HP, 600/1200 RPM, General Electric.
1—35 HP, 500/1500 RPM, Westinghouse.
1—35 HP, 350/1050 RPM, Electro Dynamic.
1—30 HP, 225/900 RPM, Crocker Wheeler.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—15 HP, 300/1200 RPM, GE.
1—13/18 HP, 350/1200 RPM, Electro Dynamic
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.
1—5 HP, 400/1600 RPM, Diehl.
1—5 HP, 225/900 RPM, Electro Dynamic.

### ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—400 KVA, 400 RPM, 240 volt, Westg.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—200 KVA, 3600 RPM, 240 volt, Allis Chal.
1—62½ KVA, 3600 RPM, 220 volt, Allis Chalmers.





### TURBO-GENERATORS

2—1000 KW, 3 ph., 60 cy., 2300/4150 v., cond.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 v. cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

### TRANSFORMERS

2—400 KVA, G.E., 4156-240/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—250 KVA, Westinghouse, 5500/440 volts.
2—200 KVA, GE, 2300/4600-230/460 volts, Scott taps.
1—200 KVA, Pittsburgh, 7800-110/220 volts.
3—150 KVA, G.E., 33,000-2300/4000 Y.
1—150 KVA, GE, 2400-120/240 volts.
3—100 KVA, Westinghouse, 11,430/250 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
1—100 KVA, GE, 2200-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3—75 KVA, GE, 13,500-7500/440 volts.
1—75 KVA, GE, 3 phase, 4156Y-120/208Y.
1—75 KVA, Pittsburgh, 7600-110/220 volts.
3—50 KVA, Wagner, 4150-220 volts.
2—50 KVA, Pbgh, 7500/15,000 volts-110/220 volts.
4—37½ KVA, 2200-220/110 v.
7—25 KVA, Westg., air cooled, 440/220-110 v.
1—25 KVA, GE., 220/110-220/110 volts.
2—15 KVA, G.E., 2300-115/-230 volts.
4—10 KVA G.E., 2300-115/230 volts.
3—7½ KVA, G.E., 440-110/220 volts.

### OIL CIRCUIT BREAKERS

1—3000 amp., 15,000 v., 3 pole, G.E., type FK-130.
1—3000 amp., 600 v., 4 pole G.E. type FK-24
1—1600 amp. 7500 v., 4 pole Westg., B-2.
1—1200 amp., 15000 v., 4 pole, Westg., B-2.
Also complete stock of small sizes.

# IT'S "HEMPHILL" for POWER EQUIPMENT

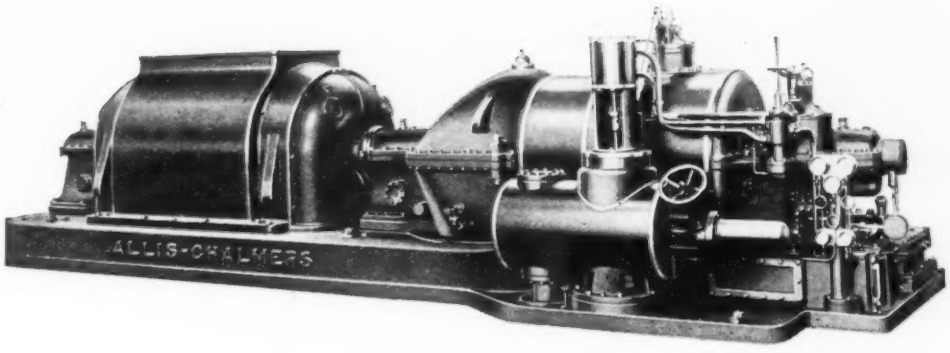
**J. L. HEMPHILL & CO.** PHONES { NEW YORK: LOngacre 5-3227 / NEW JERSEY: UNion 3-2600

1602 53rd STREET, NORTH BERGEN, N. J.

# DEPENDABLE

# Turbo-Generators

**It is the Practice of this Company to Confine its Inventory Strictly to Comparatively Modern, Little Used Turbines Some Are Practically New**




2—Allis-Chalmers, 2500-KVA, 3/60/2300-volt, 200#-P, 500°F-TT, Surface Condensers

## PART OF OUR INVENTORY—BELOW

1—Westinghouse 6250-KVA, 3/60/2300-v, 200# 500°F. TT. Surface Condenser.

1—Allis-Chalmers 4000-KVA, 3/60/2300-v, 200#, 500°F, TT, Condensing.

1—G.E., 2500-KVA, 3/60/600-v, 200# 500°F. TT. Condensing.

1—G.E., 1563-KVA, 3/60/2300v, 175#, 100° SH, 28". Surface Condenser.

1—General Electric 1563 KVA Non-condensing 3/60/600 volts 150#.

1—Westinghouse 1000—KW, 250-volt, Direct Current, Condensing, 150/250# pressure. Surface Condenser.

1—Allis-Chalmers 1250-KVA, 3/60/2300-v, 200#, 500° TT. Surface Condenser.

1—G.E., 1250-KVA, 3/60/480-v, 175#-P and 16# Abso. Mixed Pressure.

1—937 KVA Non-Condensing 3/60/480 Volts 400# gauge 100°F superheat.

1—G.E., 937-KVA, 3/60/2300v, 200#, 500°-TT, 3-Stage Condensing.

1—Allis-Chalmers, 937-KVA, 3/60/2300-v, 200#, 500°-TT, Condensing Surface Condenser.

1—G.E., 625-KVA, 3/60/2300-v, 200# 500° TT. Condensing.

1—G.E., 625-KVA, 3/60/600-v, 250#, 550°F-TT, Condensing Modern.

1—General Electric 250 KVA Non-Condensing 3/60/480 Volts, 140#

**WILMS, WEAVER & CO. Penobscot Building DETROIT, MICH.**

*We Deal in Turbo-Generators Exclusively*

# RE-NU-BILT BY BELYEA...

## MOTOR GENERATOR SETS

**3 phase—60 cycle**

1—1500 KW G.E. 600 V. Gen. d.c. to 2100 HP 6600 V. Syn. motor.

1—500 KW Whse. 250 V. Gen. d.c. to 700 HP 2300 V. Syn. motor.

1—500 KW G.E. 600 V. Gen. d.c. to 700 HP 13200 V. Syn. motor.

1—150 KW G.E. 550 V. Gen. d.c. to 225 HP 2300 V. Syn. motor.

## D. C. MOTORS

| HP | Make | Type | Volts | Speed |
|---|---|---|---|---|
| 1—1500 | Whse. | | 550 | 330 |
| 2—1250 | G.E. | MPC | 500 | 130 |
| 1— 800 | G.E. | MPC | 550 | 600 |
| 1— 625 | G.E. | MPC | 250 | 130 |
| 1— 600 | G.E. | MPC | 550 | 600/800 |
| 1— 600 | Whse. | | 230 | 150/275 |
| 2— 350 | G.E. | MPC | 230 | 450 |
| 1— 300 | G.E. | MPC | 230 | 275/550 |
| 1— 300 | G.E. | MPC | 230 | 250/400 |
| 1— 200 | Whse. | | 230 | 400/500 |
| 2— 150 | Whse. | SK | 230 | 300/900 |
| 1— 100 | Al. Ch. | | 230 | 950/1150 |

## ROTARY CONVERTERS

**60 cycle**

1—1500 KW Whse. 720 RPM 650 V. D.C. with transformers 11500 V. and panels.

1—1250 KW G.E. 720 RPM 250 V. D.C. with transformers 2300 V. and panels.

1—1000 KW. Whse., 900 RPM, 600 V. D.C with transformers 2200 V. and panels.

2—750 KW Whse. 1200 RPM 600 V. D.C. with transformers 2300/6600 V. and panels.

**25 cycle**

3—1500 KW G.E. 500 RPM 225/275 V. D.C. Booster type with 6600 V. transformers and panels. **Actual photo** of one at right side center cut.

1—500 KW G.E. 750 RPM 225/275 D.C. Booster type with 6600 transformers and panels.

## A. C. MOTORS

**3 phase—60 cycle**

### SLIP RING

| HP | Make | Type | Volts | Speed |
|---|---|---|---|---|
| 2—1200 | Cr.Wh. | 8010 | 2300 | 237 |
| 1— 800 | Al. Ch. | ANY | 440 | 885 |
| 1— 600 | G.E. | IM | 2200 | 900 |
| 1— 450 | Whse. | HW | 2200 | 875 |
| 1— 400 | Al. Ch. | ANY | 440 | 1200 |
| 1— 400 | G.E. | MT | 550/440 | 300 |
| 1— 400 | Al. Ch. | ANY | 2300 | 505 |
| 1— 350 | G.E. | MT-442 | 2300/4000 | 257 |
| 1— 250 | G.E. | MT | 4000/2300 | 257 |
| 1— 250 | G.E. | MT-410 | 2300 | 390 |
| 2— 200 | Whse. | CW | 2200 | 514 |
| 2— 175 | G.E. | IE-15A | 2200 | 880 |

### SQUIRREL CAGE

| HP | Make | Type | Volts | Speed |
|---|---|---|---|---|
| 1—500 | G.E. | I-17B | 2200 | 690 |
| 1—300 | Whse. | CS | 550 | 580 |
| 1—300 | Al. Ch. | | 2200 | 1160 |
| 1—300 | G.E. | IK | 440/2300 | 600 |
| 1—250 | Al. Ch. | | 220/440 | 1150 |
| 1—200 | G.E. | IK | 2200 | 490 |
| 1—200 | Whse. | CS | 4600 | 900 |
| 1—200 | Whse. | CS | 550 | 720 |
| 1—200 | Whse. | CS | 440 | 580 |
| 1—150 | Al. Ch. | AN | 220/440 | 1750 |

## TURBO GENERATOR SETS

1—500 KW Whse. 625 Kva. 440 V. 3 ph. 60 cy. 3600 RPM with Parsons 145/175 lb. condensing turbine complete with jet condenser and accessories.

1—500 KW G.E. 625 Kva 2300 V. 3 ph. 60 cy. with Curtis 4 stage 150 lb. condensing turbine with condenser and accessories.

1—75 KW Ridgeway 250 V. D.C. with Terry turbine 180 lb. pressure with 12 lb. back pressure, 2600 RPM.

## TRANSFORMERS

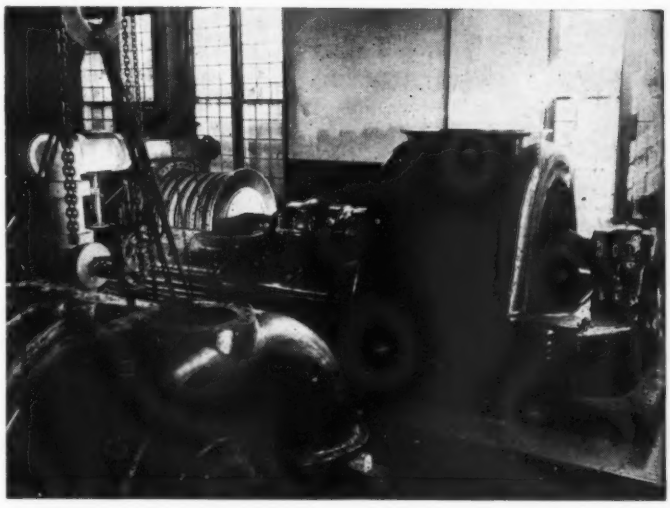
**60 cycle**

| KVA | Make | Ph. | Type | Voltages |
|---|---|---|---|---|
| 1—1500 | Whse. | 3 | OISC | 26400/13200/440 |
| 3—1000 | G.E. | 1 | HKDD | 13200x2300 |
| 3— 300 | Pitts. | 1 | OISC | 2300x115/230 |
| 3— 300 | G.E. | 1 | H | 13200x2300/575 |
| 3— 200 | G.E. | 1 | HLLD | 26400x115/460 |
| 3— 150 | Whse. | 1 | SKM | 2400x120/240 |
| 1— 150 | G.E. | 3 | HT | 2300/4000x115 |
| 3— 100 | Whse. | 1 | OISC | 13200x250 |
| 4— 75 | Pitts. | 1 | OISC | 2300x575 |

# BELYEA COMPANY, INC.

**Main Office and Shop**

**43 HOWELL ST., JERSEY CITY, N.J.**



# 7500 Kw Condensing Turbo-Alternator

**7500 KW 80% Curtis General Electric 6-stage Reaction Pattern Condensing Turbo (in record log service performing at 10/11000 KW.) Unit is 60/3/5000/1800 RPM/200# 150° Superheat (has been operated standardly under 250# ISP). Steel steam chest and throttle valve; generator mica insulated. Standard operating temperature rated 40°C. Wheeler Surface Condenser equipped.**

**CONDITION: In personal disassembly inspection accompanied by parent experts, recently completed, the fact of quality almost equal to new has been verified.**

## TURBOS—60 cycles

15000 KW performance 40° Impulse and Reaction Semi-Double Flow Condensing unit with non-automatic bleeder facility, 200# design (approved and adaptable with slight changes for 400# and non-automatic in max. volume at either 100# or 65# GPB (single parallel theory for 2300 volts). Surface Condenser and all auxiliaries complete. "In RANGE".

4000 KVA Allis-Parsons design Turbo 60/3/4150 volts Star (perhaps regroupable standard theory 2300 volts Delta). Original design Condensing and operated at 5000 KW for short period, then altered for NC heating by-process load after removal of 4 rows LP blades (would require new blading for condensing). Now Surface Condenser equipped with all standard auxiliaries.

2000 KW rated Allis-Parsons (approx. 3000 KW normal) 60/3/440, no Condenser (would operate efficiently at approx. rated log NC plan at approx. 18# GP).

2000 KW GE Curtis 6-stage Reaction design 60/3/2300/1800 RPM Condensing and Non-Automatic Bleeder, Surface Condenser equipped. Has log record of 2600 KW constant at 40°. Total log service record 8000 hours (approved non-automatic bleeder theory 30,000# 20# BP. 1800/2000 KW performance.

2000 KW Westinghouse Reaction design 60/3/2300/1800 RPM. Now Barometric Condenser equipped. Officially approved for NC plan at minimum 1500 KW 18# BP. Operators vouch for first-class condition thruout.

## TURBOS—25 cycles

25 Cycle Condensing turbos of total approx. capacity of 30/40,000 KW 25/3 various standard voltages. Surface Condensers. Short actual log and first-class condition.

## SURFACE CONDENSERS

Surface condenser units complete in following general capacity range 20,000 sq. ft., 15,000, 12,000, 11,000 and 8,200 sq. ft. Also other smaller units.

## WATER TUBE BOILERS

1400 HP 650# 200° SUPERHEATER EPUIPPED BENT TUBE STOKER DESIGNED UNIT EQUIVALENT BRAND NEW.

3-525 HP BOX STEEL HEADER CROSS DRUM 200# ASME INSPECTED AND PASSED CHAIN GRATE STOKERS, ALL PLANT PIPING, CONSIDERABLE AUXILIARIES.

8-400 HP B&W STIRLINGS POWDERED COAL EQUIPPED, SUPERHEATERS, WATER COOLED WALLS AND AIR-COOLED SIDE WALLS, SOOT BLOWERS, COAL AND ASH HANDLING, FORCED DRAFT FANS, FEED WATER HEATERS, METERS, GAUGES, ETC. COMPLETE 3200 HP BOILER PLANT, STEEL BUILDING CAPABLE OF DISMANTLING, ETC. SHORT LOG SERVICE. 200# ASME IDENTIFIED, APPROVED IN RECENT INSPECTION. COMPLETE BOILER PLANT LAYOUT.

4-500 HP B&W Sectional Header 200#, Chain Grate Stokers.

Approximately 12 smaller straight tube and bent Tube Boilers 200# of 350/500 HP.

**PIONEER PERSONAL SERVICE COOPERATION IN HEAVY POWER**

**THRU THREE WARS—1892 - 1942**

**IN INTEGRITY OF PLAN AND PERFORMANCE**

# 1500 KW MOTOR GENERATOR SET

## AVAILABLE IMMEDIATE DELIVERY

1—ALLIS CHALMERS Motor Generator Set consisting of:
1500 KW, 600 Volt Direct Current Generator Direct Connected to a 2190 HP, 3 Phase, 60 Cycle, 4000/6600 Volts, 300 RPM Synchronous Motor.

### TURBINE-GENERATOR UNITS

**3 phase, 60 cycles**

6250 KVA Westinghouse condensing 175-200 lb. pressure, 2300 volts, complete with surface condenser and auxiliaries.

3125 KVA Westinghouse 180-200 lb. pressure, 500° T.T. 2300 volts, 3600 RPM equipped with surface condenser, condensing auxiliaries, exciter unit, switchboard with instruments—(a complete installation).

1563 KVA G.E. condensing 175-200 lb. pressure 500° T.T., 2300 volts, 3600 RPM, complete with surface condenser and condensing auxiliaries.

1250 KVA ALLIS condensing 150-200 lb. pressure, 100° superheat, 2300 volts, 3600 RPM, complete with Wheeler surface condenser.

937 KVA G.E. condensing 200 lb. pressure, 100° SH, 2300 volts, 3600 RPM complete with condenser, exciter, switchboard and instruments.

937 KVA Allis condensing 200 lb. pressure, 100° superheat, 2300/550/480 volts, 3600 RPM complete with direct connected exciter, and either with a surface or jet condenser. Modern.

937 KVA ALLIS condensing 150 to 200 lb. pressure, 475° TT, 2300 volts, 3600 RPM, complete with direct connected exciter, surface condenser and auxiliaries.

750 KVA G.E. condensing 150-200 lb. pressure, 2300 volts, 3600 RPM, complete surface condenser and exciter set.

625 KVA G.E. condensing 200 lb. pressure, 2300 volts, 3600 RPM, complete with condenser and auxiliaries.

### TURBINE-GENERATOR UNITS (Con't.)

375 KVA G.E. condensing 150-200 lb. pressure, 100° superheat, 2300 volts, 3600 RPM, complete with surface condenser auxiliaries.

375 KVA (2) G.E. non-condensing 150-175 lb. pressure, 5 lb. back pressure, 2300 volts, 3600 RPM each complete with direct connected exciter and rheostats.

### ENGINE-GENERATOR UNITS

**3 phase, 60 cycle—Alternating Current**

1000 KVA G.E. 480 volts, 150 RPM direct connected 31" x36" Skinner Uniflow engine, complete exciter, switchboard panel and instruments.

500 KVA G.E. 240/480 volts, 150 RPM direct connected 26"x32" Skinner, Universal Unaflow non-condensing engine, 130-160 lb., 6 lb. back pressure, complete exciter and rheostats.

438 KVA General Electric 2300 volts, 200 RPM alternating current generator direct connected to Busch Sulzer vertical full Diesel engine.

312 KVA Elliott 4000/2300/550 or 240 volts, 180 RPM direct connected to 17" x 24" Elliott Unaflow non-condensing engine, 175 lb. pressure, 6 lb. gauge back pressure.

300 KVA G.E. 240 volts, 120 RPM direct connected 18"x 36" Hamilton Corliss engine, 125-150 lb. pressure, 5 lb. gauge back pressure, complete exciter, switchboard and instruments.

135 KVA General Electric 2300 volts, 277 RPM alternating current generator direct connected to Busch Sulzer *vertical full Diesel engine.*

### ENGINE-GENERATOR UNITS

**Direct Current**

600 KW Crocker - Wheeler 250 volts, 300 RPM direct connected to a 14" x 18", 4 cylinder Ames vertical Unaflow non - condensing engine, 150 to 175 lb. pressure, 5 lb. gauge back pressure complete switchboard and instruments.

300 KW WESTINGHOUSE 250 volts, 175 RPM direct connected 24"x26" Skinner Unaflow non - condensing engine, 110-150 lb. pressure, 5 lb. back pressure, complete switchboard and instruments.

150 KW Crocker-Wheeler, 125 volts, 200 RPM direct connected to an Erie Ball single cylinder, 4-valve, non-releasing Corliss engine complete with switchboard.

50 KW General Electric, 125 volts, 1200 RPM direct connected 75 HP Terry non - condensing turbine, 150 lb. pressure, 15 lb. back pressure, complete with switchboard.

### MOTOR GENERATOR SET

100 KW Electric Machinery 125 volt direct current direct connected to 150 HP, 3 phase, 60 cycle, 440 volt, 1200 RPM synchronous motor complete with switchboard equipment.

### MOTORS

**3 phase, 60 cycle**

620 HP G.E. type ATI, form S, 440 volt, 164 RPM synchronous.

600 HP Allis 2200 volts, 600 RPM two-bearing slip ring with control.

500 HP General Electric, type MT, 2300 volts, 450 RPM, three-bearing slip ring with control.

300 HP, 80% P.F. WESTINGHOUSE 2300 V., 200 RPM synchronous.

125 HP 80% P.F. Elec. Mchy. 440 V., 400 RPM synchronous with starting equipment.

50 HP, type 1, form M, 3 phase, 60 cycle, 2200 volts, 1200 RPM slip ring.

50 HP Allis-Chalmers, 440 volts, 600 RPM squirrel cage.

### MISCELLANEOUS

1500 KVA, 3 phase, 60 cycle, 22,000 volt primary, 2300 volt secondary WESTINGHOUSE transformer.

500 KVA IDEAL, 3 phase, 60 cycle, 240 volts, 400 RPM, three-bearing belted type generator with direct connected exciter and rheostats.

312 KVA WESTINGHOUSE, 3 phase, 60 cycle, 2300 or 220 volts, 200 RPM, engine type generator with belt driven exciter and rheostats.

300 KVA General Electric, 3 phase, 60 cycle, 440 volt, 600 RPM, three bearing belted generator complete with switchboard.

200 KVA WESTINGHOUSE, 3 phase, 60 cycle, 240 volts, 200 RPM engine type generator with rheostat.

87 HP (3) G.E., type MDS, form A, 230 volts, 500 RPM series wound direct current motors.

1 ELLIOTT EHRHART jet condenser with all auxiliaries suitable for operation with a 5000 KW turbine-generator unit.

1055 cubic feet, 100 lb. air pressure CHICAGO PNEUMATIC horizontal compressor direct connected to 170 HP, 240 V., 150 RPM General Electric direct current motor.

512 HP Babcock & Wilcox Sterling 4-drum water tube boiler code construction, 200 lb. pressure, single setting complete with stoker.

**Synchronous condensers 1350 KVA total capacity**

**750 KVA and 600 KVA, General Electric type ATI, 3 phase, 60 cycle, 240 volts, 900 RPM synchronous condensers.**

**Each unit is complete with direct connected exciter, switchboard panel with instruments.**

**Are in A#1 operative condition — still on original foundation for operating test.**

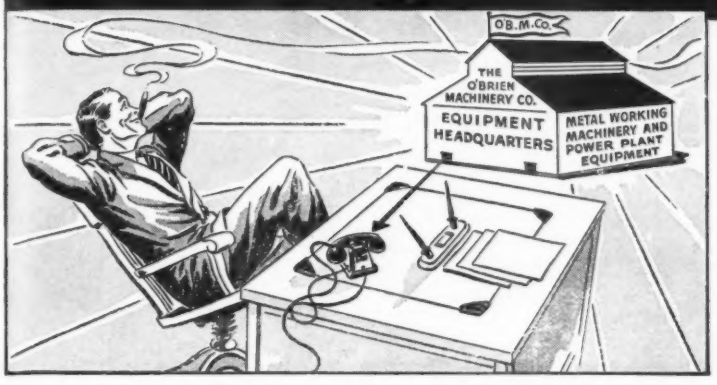
**Utilities Electrical Machinery Corporation**

600 NATIONAL CITY BANK BLDG.
CLEVELAND, OHIO

WIRE OR PHONE
LONG DISTANCE 422

**NOT THIS . . .** Splitting the responsibility for furnishing plant equipment wastes time, trouble, transportation and telephone calls. Why do it when time is so precious, dependability and delivery so vital to your production?

★ THIS ★ ★ NOT THIS ★




**BUT THIS . . .** From *one source* you can secure *all* your requirements, not only for metal working machinery but for all types of power plant equipment to operate them. Place your complete order with one responsible supplier—O'Brien—and say goodbye to your equipment headaches.

# TELL US *ALL* YOUR EQUIPMENT NEEDS

***Let us fill your entire equipment order. Check carefully this current list of offerings. Many others available.***

## COMPLETE POWER PLANT

1—750 KW Al.Ch.—Moore Bleeder Non-Condensing Turbo Generator Set, 3 ph., 60 cycle, 480 volt, 3600 RPM; built for 190# gauge, 100 deg. F.S. Superheat, bleeding at 75#, exhausting at 10#. Adjustable nozzle to carry full load with 160# gauge saturated. All accessories included.

— A L S O —

2—633 HP Bigelow Hornsby W. T. Boilers, 225# ASME with water softener, feed water heater, boiler feed pumps, draft fans, preheaters, all trimmings.

LOCATED IN PHILADELPHIA AREA NOW IN USE
IMMEDIATE RELEASE

## MOTOR GENERATOR SETS

1000 KW General Electric 3 unit Set with 2—500 KW, 150 volt D.C. Generators, 1400 HP Synchronous 3 phase. 60 cycle, 4000 volt, 514 RPM.
500 KW Westinghouse 125/250 volt, 900 RPH, 3/60/2300/4100 volt, Syn., A.C. and D.C. Panels, already rebuilt, immediate shipment.
275 KW Allis-Chalmers, 3-unit set, 450 RPM—
150 KW Gen., 150 volt and 125 KW Gen., 240 volt.
400 HP Syn.Motor, 3/60/4500 volt.
2—200 KW Westinghouse, 125 volt, 900 RPM, 2/3 phase, 60 cycle. 2300 volt.
150 KW Gen. Elec. type MP, 250 volt, 514 RPM, 200 HP Syn. 3/60/2300.
2—150 KW Westinghouse Rotary Converters, 250 volt, 6 phase, 1200 RPM with O.C.Bs. and Transformers, 2300/3/C0.
1—100 KW General Electric, 125 volt, 900 RPM, 2/3 phase, 60 cycle, 220 volt.
100 KW Gen. Elec. 125/250 volt, 1200 RPM, 3/60/440.
85 KW West. 250 volt, 135 HP sq. cg., 3/60/220.
75 KW West. 125 volt, 112 HP sq. cage, 3/60/2300/1200 RPM.
2—75 KW Westinghouse. 250 volt, 3 phase, 60 cycle, 220 volt, 1200 RPM.
75 KW Elec. Mchy. 125 volt, 1200 RPM, 112 HP Syn., 3/60/2200.
1—50 KW General Electric, 125 volt, 3 phase, 60 cycle, 2200 volt, 720 RPM.
50 KW Gen. Elec., 250 volt, 3/60/440/900 RPM.
35 KW Fairbanks-Morse, 250 volt, 60 HP Synchronous Motor, 3/60/220/1200 RPM.
25 KW Gen. Elec., 250 volt, 1200 RPM, 3/60/440.
25 KW Westinghouse, 125 volt, 1200 RPM, 3/60/220 volt.
5 KW Westinghouse SK, 125 volt, 3/60/220/1800 RPM.

## AIR COMPRESSORS

| CFM | MAKE | SIZE | TYPE |
|---|---|---|---|
| 2312 | Ingersoll-Rand | 20x20x16 | Steam |
| 1400 | Ingersoll-Rand | 22x14x16 | Steam |
| 1156 | Ingersoll-Rand | 20x12½x16 | Steam |
| 1198 | Ingersoll-Rand | 16x16x14 | Belt |
| 888 | Ingersoll-Rand | 19x12x16 | Belt |
| 599 | Ingersoll-Rand | 16x10x14 | Belt |
| 528 | Ingersoll-Rand | 14x12 | Belt |
| 368 | Ingersoll-Rand | 12x10 | Belt |
| 368 | Ingersoll-Rand | 10x12x10 | Steam |
| 311 | Ingersoll-Rand | 12x8 | Belt |
| 311 | Pennsylvania | 12x8 | Belt |
| 240 | Pennsylvania | 10x9 | Belt |
| 136 | Gardner-Denver | 8x8x8 | Steam |
| 80 | Ingersoll-Rand | 6x5 | Belt |

## CENTRIFUGAL PUMPS

3/60/220/440/2300

| GPM | MAKE | SIZE | HEAD | RPM |
|---|---|---|---|---|
| 3500 | Le Courtney | 10" | 350' | 1800 |
| 2200 | Le Courtney | 6" | 220' | 1200 |
| 1500 | De Laval | 8" | 40' | 1750 |
| 1200 | De Laval | 8" | 60' | 1750 |
| 400 | Worthington | 4" | 60' | 1750 |
| 300 | Goulds | 3" | 150' | 3450 |
| 300 | Twin Volute | 3" | 60' | 1750 |
| 250 | De Laval | 3" | 60' | 1750 |
| 175 | Dayton Dowd | 2½" | 140' | 1750 |

***Everything from a Pulley to a Power House***

*We are also representatives in the Philadelphia area for many of the leading national manufacturers of new machinery*

# THE O'BRIEN MACHINERY CO.

**PHILADELPHIA'S LARGEST MACHINERY DEALERS AND EXPORTERS**

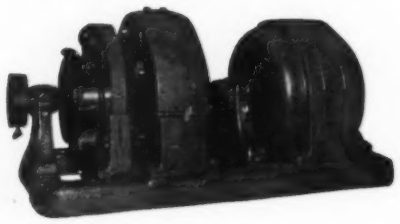
**113 NORTH THIRD STREET • PHILADELPHIA - PENNA.**

BELL TELEPHONE: MARKET 4180 CABLE ADDRESS OBRIEN-PHILA

# Electric Equipment—Stock Shipment

## Generators Transformers Breakers

### MOTOR GENERATOR SETS



1—300 KW. General Electric type MPC 4 million, 250 volt, DC compound interpole, 720 rpm., 3 bearing on base to 485 HP. General Electric type ATI, synchronous motor, 440 volt, 60 cycle, 3 phase, 720 rpm. all complete with controls.

1—100 KW. Crocker Wheeler type CCD 65H, 125 volt, 1200 rpm. compound interpole, on base to 150 HP. Crocker Wheeler squirrel cage, Type SC, 2200 volt, 60 cycle, 3 phase, 1200 rpm.

1—100 KW. Crocker Wheeler 275 volt DC, 1800 rpm. on base to 150 HP. Crocker Wheeler type SC, 2200 volt, 60 cycle, 3 phase, 1800 rpm.

1—75 KW. General Electric type RC 18, 125 volt, 750 rpm. on base to 115 HP. General Electric squirrel cage, 2200 volt, 25 cycle, 3 phase 750 rpm.

2—75 KW. West. Type SK, factory built, 250 volt, 1200 rpm. on base, to 112 HP. squirrel cage, type CS motor, 220 volt, 60 cycle, 3 phase, 1200 rpm.

1—50 KW. General Electric RC 34, 125 volt, 1200 rpm. on base to 75 HP. KT 343, 2200 volt, 60 cycle, 3 phase, 1200 rpm.

1—50 KW. West. type SK 160, 125 volt, 750 rpm. on base to 75 HP. TYPE CS, 2200 volt, 25 cycle, 3 phase, 750 rpm.

1—25 KW. Imperial NEW, 125 volt, DC 1800 rpm. on base, to 40 HP. Imperial type E 45, 440 volt, 60 cycle, 3 phase, 1200 rpm.

1—20 KW. General Electric type RC, 125 volt, 1800 rpm. compound interpole, to 30 HP. KT, 2200 volt, 60 cycle, 3 phase, 1800 rpm.

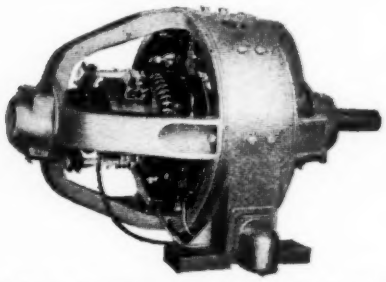
1—17 KW. General Electric 125 volt, 1200 rpm. on base to 25 HP. General Electric 550 volt, cycle, 60; 3 phase, 1200 rpm.

1—15 KW. General Electric type CD 83, 250 volt, 1800 rpm. on base to 25 HP. KT 503, 550 volt, 60 cycle, 3 phase, 1800 rpm.

1—12 KW. General Electric type CD 75, 125 volt, 1800 rpm. on base to 20 HP. KT 501, 220/440 volt, 60 cycle 3 phase, 1800 rpm.

16 Sets both 125 and 250 volt, DC. Very late types, REBUILT up to 10 KW. Send inquiries and we will quote

### ADJUSTABLE SPEED MOTORS



### ADJUSTABLE SPEED DC, 230 VOLTS MOTORS

| Quan. | H.P. | Make | Type | Speed |
|---|---|---|---|---|
| 1 | 175 | G. E. | DLC 308 | 650/925 |
| 2 | 60 | Sprague | Shunt Interph. | 480/1100 |
| 1 | 50 | G. E. | RLC Planer Duty | 250/1000 |
| 1 | 35 | West. | SK | 500/1500 |
| 1 | 30 | West. | SA | 500/1500 |
| 1 | 30 | Elec. Dyn. | #20S5223 | 400/1200 |
| 1 | 25 | G. E. | RF 14 | 400/1200 |
| 1 | 25 | West. | SK 140 | 400/1200 |
| 1 | 25 | Elec. Dyn. | 20S | 400/1200 |
| 2 | 20 | West. | SK | 400/1200 |
| 1 | 20 | G. E. | RLC 115 | 600/1200 |
| 1 | 15 | West. | SK, Ball Bearing | 750/1800 |
| 1 | 15 | G. E. | RF 11 | 400/1600 |
| 1 | 15 | West. | SK 80L | 1150/1800 |
| 1 | 15 | West. | SK | 400/1600 |
| 2 | 15 | West. | SK | 400/1500 |
| 1 | 13 | G. E. | RLC 115 | 500/1500 |
| 1 | 12 | West. | SK Enclosed | 600/ 900 |
| 1 | 12 | West. | SK 100L | 375/1500 |
| 4 | 11 | West. | SK | 450/1800 |
| 1 | 10 | G. E. | RF 11, Planer Duty | 250/1000 |
| 1 | 10 | West. | SK 90 | 600/1800 |
| 1 | 10 | West. | SK | 400/1600 |
| 1 | 10 | G. E. | RF 10 | 400/1600 |
| 2 | 10 | G. E. | RF 10A | 600/1800 |
| 1 | 10 | G. E. | RLC | 500/1500 |
| 1 | 7½ | G. E. | RF 10A | 450/1350 |
| 1 | 7½ | G. E. | RLC 114 | 400/1200 |
| 1 | 7½ | G. E. | RF 10 | 475/1425 |
| 1 | 7½ | West. | SK | 285/ 855 |
| 1 | 7½ | Reliance | 13 IT | 300/1200 |
| 1 | 7½ | G. E. | RF 10A | 475/1350 |
| 1 | 7½ | G. E. | RF 9 | 600/1800 |
| 1 | 5 | G. E. | RF 7 | 650/1950 |
| 1 | 5 | West. | SK | 600/1800 |
| 1 | 5 | West. | SK 83, Planer Duty | 250/1000 |
| 1 | 5 | Al-Ch. | E-120 | 450/1800 |
| 1 | 5 | G. E. | RF | 450/1800 |
| 1 | 5 | West. | SK | 600/1800 |
| 1 | 5½ | West. | SK | 500/1500 |
| 1 | 5 | G. E. | CD 83 | 450/1800 |
| 2 | 3 | G. E. | RF 7 | 650/1950 |
| 2 | 3 | G. E. | RF 9 | 450/1350 |
| 5 | 3 | G. E. | RF 7 | 500/1500 |
| 1 | 3 | G. E. | CD 73 | 500/1500 |
| 2 | 2 | G. E. | RF 7 | 500/2000 |
| 1 | 2 | G. E. | CD 65 | 500/2000 |
| 1 | 1½ | West. | SK 20 | 450/1800 |
| 1 | 1½ | G. E. | CD 55 | 500/2000 |
| 2 | 1½ | G. E. | RA 6 | 500/1500 |
| 1 | 1 | G. E. | BD 43 | 700/2100 |
| 1 | ½ | G. E. | RA 4 | 500/1800 |

***We also have several 115 Volt DC variable speed motors. Send inquiries***

**WLB RULING L-221**

**"(ii) The purchaser shall have attempted to obtain, from at least three dealers, a used motor or generator for the purpose for which the new motor or generator is sought to be purchased:"**

**TRANSFORMERS — SAFETY SWITCHES — CAPACITORS — METERS — PANELBOARDS — COMPENSATORS. REMEMBER—SOME OTHER PLANT CAN USE THE EQUIPMENT YOU DON'T NEED. SEND US YOUR LISTS—WE WILL BUY FOR CASH AND RE-SELL TO DEFENSE PLANTS.**

***Above is only partial list, send us your requirements.***

**ELECTRIC EQUIPMENT CO.**

678 LAKE AVE. **Phone Glenwood 6783** ROCHESTER, N. Y.

# REBUILT POWER EQUIPMENT

**READY TO SHIP!**

## ROTARY CONVERTERS

2—200 kw. G.E. 275 v. 900 rpm., 6 ph. 60 cy. complete with overspeed device and transformers.
2—500 kw. G.E. type HC-8 600 volt, 900 rpm., 6 ph., 60 cy. pedestal bearing with overspeed device complete with transformers.

## MOTOR GENERATOR SETS

200 kw. Westinghouse 600 v. D.C. 600 rpm., dir. con. 2200/3/60 Syn. Motor Complete.
1—150 kw. Westinghouse 250 v. 600 rpm., dir. con. 2200/3/60 syn. motor.
125 kw. Crocker Wheeler 250 V. D.C. 1200 rpm., 220/440 v., 3 ph. 60 cy. Induction
100 kw. G.E. 550 v. 900 rpm. dir. con. 2200/3/60 Syn. Motor.
1—75 kw. G. E. 250 v. 900 rpm., dir. con. 2300/3/60 Syn. Motor.

## ENGINE GENERATOR SETS

225 kw. Elec. Machy. 2200 or 220 v. 2 ph. 60 cy. dir. con. Ideal Steam.
1—225 kw. Elec. Machy. 2200/220 or 440 v. 3 ph. 60 cy., 200 rpm., dir. con. Ideal Engine 4 valve non-releasing.

## 100 HP. LIDGERWOOD HOIST

Double drum Speedwell 2500 lb. pull at 450' per min. direct driven by 100 hp. A.C. or D.C. Motor.

## CHAIN HOISTS

30—2 ton Yale & Towne complete with 3 ton trolleys.

## A.C. GENERATORS

219 kva. G.E. 2300/3/60 200 rpm. 80% P.F. Can be reconnected 440 or 220 v.)
2—120 kw. G.E. 220/440 v. 3 ph. 60 cy. 900 rpm., 80% P.F.

## GAS ENGINE GENERATOR SET

75 kw. West. 250 v. belted to 110 HP 2 cyl. Bessemer Gas Engine.

## SLIPRING MOTORS—3 ph. 60 cy.

| No. | HP | Make | Type | Volts | rpm. |
|---|---|---|---|---|---|
| 1 | 1500 | Allis Chal. | ANY | 2200 | 485 |
| 1 | 700 | G.E. | MT-432 | 2200 | 393 |
| 1 | 400 | West. | CW | 2200/550/220 | 435 |
| 1 | 400 | West. | CW-967A | 220/440 | 1170 |
| 1 | 300 | G.E. | I-M | 220/440 | 600 |
| 1 | 260 | Burke | EMV-65 | 220/440 | 600 |
| 3 | 250 | G.E. | I-M | 550 | 600 |
| 3 | 250 | G.E. | I-M | 2200/220/440 | 600 |
| 3 | 200 | G.E. | M | 2200/220/440 | 600 |
| 1 | 200 | G.E. | I-M | 2200 | 514 |
| 1 | 150 | G.E. | I-M | 220/440 | 900 |
| 1 | 100 | West. | CI | 220/440 | 1750 |
| 1 | 100 | G.E. | I-M-16 | 2200 | 450 |
| 2 | 100 | West. | CW | 2200 | 580 |
| 1 | 75 | West. | CW | 220 | 875 |
| 1 | 60 | West. | HF | 2200 | 690 |
| 1 | 60 | Triumph | C-16 | 220/440 | 430 |
| 2 | 60 | G.E. | MT-536 | 2200 | 1150 |
| 1 | 53 | G.E. | I-M | 220/550 | 1165 |
| 1 | 52 | G.E. | ITC-5013 | 220/440 | 570 |
| 2 | 50 | Allis Chal. | ANY | 220/440 | 900 |
| 1 | 50 | West. | HF-12A | 220/440 | 900 |
| 1 | 50 | West. | CW-461 | 220/440 | 900 |
| 1 | 50 | G.E. | | 220/440 | 850 |
| 2 | 50 | West. | HF | 220/440 | 1120 |
| 1 | 50 | West. | CW-636A | 220/440 | 1150 |
| 2 | 40 | G.E. | MT-332 | 220/440 | 1155 |
| 1 | 40 | G.E. | MTC-5522 | 220/440 | 1125 |
| 1 | 40 | G.E. | MT-342 | 220/440 | 860 |
| 1 | 40 | Allis Chal. | | 220/440 | 685 |
| 1 | 40 | G.E. | MT-552 | 220/440 | 575 |

## SYNCHRONOUS MOTORS

2—125 kw. G.E. type ATB, 220/440 v. 3 ph. 60 cy. 900 rpm., 80% PF.

## SPEED REDUCER

| Qu. | HP. | Make | RPM | Ratio |
|---|---|---|---|---|
| 20 | ¼ | Pgh. Gear | 720 | 52:1 |
| 26 | ½ | Pgh. Gear | 840 | 52:1 |
| 30 | ¾ | Pgh. Gear | 1200 | 52:1 |
| 5 | 1 | D. O. James | 850 | 24:1 |
| 25 | 1 | Pgh. Gear | 1800 | 52:1 |
| 2 | 1 | D. O. James | 850 | 55:1 |
| 7 | 2 | D. O. James | 1200 | 24:1 |
| 1 | 3 | D. O. James | 1800 | 55:1 |
| 1 | 3 | D. O. James | 850 | 20:1 |
| 1 | 3 | Farrell | 1160 | 6:1 |
| 2 | 5 | D. O. James | 1200 | 20:1 |
| 2 | 5 | Sturtevant | 900 | 14½:1 |
| 7 | 5 | D. O. James | 1700 | 24:1 |
| 15 | 5 | Tate Jones | 720 | 37:1 |
| 1 | 7½ | D. O. James | 1750 | 20:1 |
| 3 | 7½ | D. O. James | 1200 | 6.2:1 |
| 15 | 8 | Tate Jones | 800 | 36:1 |
| 5 | 10 | D. O. James | 1200 | 6.2:1 |
| 5 | 10 | D. O. James | 840 | 28:1 |
| 20 | 12 | Tate Jones | 1200 | 36:1 |
| 3 | 15 | D. O. James | 1800 | 6.2:1 |
| 5 | 15/20 | Tate Jones | 1700 | 36:1 |
| 2 | 20 | Sturtevant | 3700 | 14.5:1 |
| 5 | 30 | Poole Eng. | 600 | 5.5:1 |
| 10 | 40 | Poole Eng. | 720 | 5.5:1 |
| 4 | 50 | Poole Eng. | 900 | 5.5:1 |
| 5 | 60 | Poole Eng. | 1200 | 5.5:1 |
| 6 | 90 | Poole Eng | 1800 | 5.5:1 |
| 1 | 150 | Falk | 1200 | 7.31:1 |
| 1 | 150 | R.D. Nuttal | | 1.6:1 |
| 1 | 245 | Kerr | 1200/225 | |
| 1 | 450 | Kerr | 3800/720 | |

## TRANSFORMERS—1 ph. 60 cy.

3—1500 Kva. Pittsburgh Transformers, 22,000 volt Primary, 6900/6600/2200 volt secondary.

| No. | Kva. | Pri. | Sec. | Make | Ph. |
|---|---|---|---|---|---|
| 1 | 250 | 2300 | 460 | G.E. | |
| 3 | 150 | 22000 | 6900 | Pgh. | |
| 1 | 150 | 2200 | 230/460 | G.E. | 3 ph. |
| 1 | 100 | 2200 | 110/220 | G.E. | |
| 3 | 100 | 6600 | 550/440/220 | Pgh. | |
| 2 | 75 | 2200 | 220 | Burke | 3 ph. |
| 2 | 60 | 440 | 220/110 | West. | |
| 2 | 50 | 2300 | 220/440 | G.E. | |
| 3 | 50 | 11430/6600 | 550 | Al. Ch. | |
| 3 | 50 | 6600 | 575 | G.E. | |
| 1 | 50 | 2200 | 220 | Burke | |
| 3 | 50 | 2200 | 110/220 | West. | |
| 5 | 50 | 2200 | 110/220 | G.E. | |
| 1 | 37½ | 2300 | 220/440 | Wagner | |
| 3 | 37 | 4400 | 185 | West. (Rotary) | |
| 1 | 30 | 2200 | 110/220 | G.E. | |
| 2 | 30 | 440 | 220/110 | West. | |
| 25 | 25 | 2200 | 110/220 | G.E. | |
| 1 | 25 | 550 | 110/220 | G.E. | |
| 3 | 25 | 2200 | 110/220 | West. | |
| 3 | 20 | 2200 | 110/220 | G.E. | |
| 1 | 20 | 1100/2200 | 110/220 | Pgh. | |
| 10 | 15 | 2200 | 110/220 | G.E. | |
| 3 | 15 | 2300 | 220/440 | Pgh. | |
| 3 | 15 | 2300 | 220/440 | Pgh. | |
| 35 | 10 | 2200 | 110/220 | G.E. | |
| 40 | 10 | 2200 | 110/220 | West. | |
| 100 | 7½ | 2200 | 110/220 | G.E. | |
| 50 | 7½ | 2200 | 110/220 | West. | |
| 75 | 5 | 2200 | 110/220 | G.E. | |
| 50 | 5 | 2200 | 110/220 | West. | |

## SERIES MOTORS—230 v.

1—175 HP G.E. type MD-109¼ 475 rpm.
5— 75 HP G.E. type 211 550 rpm.
1— 68 HP G.E. CO-2007, 475 rpm.
1— 50 HP Shaw.
1— 50 HP West. K-10 (500 v.) 435 rpm.
1— 30 HP G.E. CO-2002. 610 rpm.
1— 15 HP Crocker Wheeler 270 rpm.
6 2 HP Reliance, 850 rpm.

## AIR COMPRESSORS

2—260 CFM Chic. Pneu. 12x10, 100# pres. 285 rpm., belt driven by 40 HP G.E. AC slipring Motors.

## SQUIRREL CAGE MOTORS—3 ph. 60 cy.

| Qu. | HP | Volts | Make | Type | Speed |
|---|---|---|---|---|---|
| 25 | ½ | 220/440 | Cr. Wh. with speed reducers | | 840 |
| 29 | 1½ | 220/440 | Ilg. | | 490 |
| 25 | 2 | 220/440 | Cr. Wh. | | 685 |
| 8 | 3 | 220/440 | Cr. Wh. | | 850 |
| 6 | 5 | 220/440 | G.E. | vert. | 1150 |
| 30 | 5 | 220/440 | Cr. Wh. | | 1140 |
| 25 | 7½ | 220/440 | Cr. Wh. | | 675 |
| 2 | 15/30 | 220/440 | West. | MS | 550/1100 |
| 7 | 50 | 220/440 | Wagner | | 850 |
| 3 | 60 | 220/440 | Allis Chal. with speed reducers | | 1150 to 209 rpm |
| 2 | 60 | 220/440 | Cr. Wh. | | 670 |
| 2 | 75 | 220/440 | G.E. | I-K | 720 |
| 1 | 75 | 220/440 | West. | | 1750 |
| 1 | 125 | 440 | G.E. | I-K | 720 |
| 1 | 125 | 220/550 | G.E. | I-K | 400 |
| 1 | 125 | 440 | G.E. | I-K | 450 |
| 1 | 125 | 440 | G.E. | I-K | 514 |
| 1 | 125 | 220/550 | G.E. | I-K | 850 |
| 1 | 150 | 220/440/550 | G.E. | I-K | 514 |
| 1 | 150 | 220/550 | G.E. | I-K | 450 |
| 1 | 150 | 550/220/440 | G.E. | | 575 |
| 1 | 200 | 2200 | West. | CS | 870 |
| 1 | 200 | 220/440 | West. | CS | 580 |
| 1 | 200 | 2200/440/220 | West. | CS | 250 |
| 1 | 200 | 440 | G.E. | I-K | 720 |
| 1 | 200 | 220/550 | G.E. | I-K | 600 |
| 1 | 200 | 220/550 | G.E. | I-K | 514 |
| 1 | 225 | 2200/440/220 | G.E. | TRE | 200 |
| 1 | 250 | 220/550 | G.E. | I-K | 720 |
| 1 | 300 | 2200/440/220 | West. | CS | 400 |
| 1 | 350 | 2200/440/220 | West. | CS | 450 |
| 1 | 400 | 2200/440/220 | West. | CS | 600 |
| 1 | 450 | 2200/440/220 | West. | CS | 600 |
| 1 | 400 | 2200/440/220 | West. | CS | 500 |
| 1 | 500 | 2200/440/220 | West. | CS | 720 |

## ELEVATOR

1—Westinghouse Elevator, traction type, 3000 lbs. Cap., platform 6x5, 2 gates on car, 4 sets of bi-parting doors, planed steel tees for main guides complete with AC motor and constant pressure control. All automatic.

## INDUSTRIAL TRUCKS

3—Elwell Parker Tow Tractors 7' L. x 42" W. x 42" H. 4-16" wheels, ball bearing, 4 wheel steer, 4 wheel drive, 2000# DBP complete with Edison Batteries.
1—Baker Tow Truck 8'1x64"hx48" w.
100—small steel trucks with oak platforms 42"x24" heighth 17" with 4—12" roller bearing wheels and 5th wheel including handles.

## SCALES

6—Fair. Morse #11½ 3 beams (2—200# ca. 1—50 lbs.) platform 16¼x21¾.
9—Howe Scales 3 beams—platform 14½x22.

★ *FOR VICTORY TODAY AND SOUND BUSINESS TOMORROW— BUY WAR SAVINGS BONDS* ★

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## PITTSBURGH, PA.

# The HEAT is on — America needs more POWER

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### ★ BOILERS

1—316 H.P. Heine Water Tube Boilers, 180 lbs. pressure, ASME code, complete with Jones 3 retort underfeed stokers, soot blowers, valves and piping, like new.

2—500 H.P. Heine Water Tube Boilers, 200 lb. pressure, complete with Combustion Engineering Type E underfeed stokers.

### ★ GENERATOR SETS

1—Ridgway, 750 KW Turbo Generator Set, 1800 RPM, mixed pressure turbine, 230 volt, DC Generator, complete with 3650 sq. ft. Wheeler Surface Condenser.

1—1000 KW General Electric Turbo Generator Set, 3 phase, 60 cycle, 2300 volt, 3600 RPM, turbine, 125 lbs. pressure with low level jet condenser.

### SMALL AND MEDIUM SIZE MOTORS FOR SHIPMENT

**220/440 VOLT AC—SQUIRREL CAGE**

| Quan. | HP | Make | Speed |
|---|---|---|---|
| 1 | 50 | GE | 1800 |
| 1 | 50 | Wag | 600 |
| 1 | 40 | Rel | 900 |
| 1 | 30 | Wag | 720 |
| 2 | 30 | Rel | 1200 |
| 3 | 20 | Rel | 900 |
| 1 | 20 | West | 1200 |
| 1 | 20 | U.S. | 720 |
| 5 | 15 | Rel | 900 |
| 1 | 15 | Wag | 900 |
| 2 | 15 | Cent | 1200 |
| 3 | 5 | GE | 3600 |
| 1 | 5 | West | 1800 |
| 2 | 5 | GE | 1200 |
| 5 | 3 | Imp | 3600 |

**220/440 VOLT—SLIP RING**

| Quan. | HP | Make | Speed |
|---|---|---|---|
| 1 | 30 | GE | 900 |

**2300 VOLT—SQUIRREL CAGE**

| Quan. | HP | Make | Speed |
|---|---|---|---|
| 3 | 100 | GE | 720 |
| 3 | 75 | GE | 900 |
| 4 | 75 | GE | 720 |
| 2 | 60 | GE | 900 |
| 2 | 50 | GE | 900 |
| 2 | 35 | GE | 900 |

**SYNCHRONOUS**

1—268 HP GE with belted Exciter—2300 V. 600 rpm
2—75 HP GE with direct conn. Exciters—220 V. 900 rpm

**550 VOLT—SLIP RING**

| Quan. | HP | Make | Speed |
|---|---|---|---|
| 1 | 25 | GE | 900 |
| 2 | 15 | GE | 900 |

**MOTORS**

**230 Volt DC**

| Quan. | HP | Make | Type | Speed |
|---|---|---|---|---|
| 1 | 100 | Rel | T | 500 |
| 3 | 50 | West | SK | 565 |
| 1 | 40 | AC | | 950/1150 |
| 1 | 35 | GE | LC | 650 |
| 1 | 30 | AC | | 575 |
| 1 | 25 | West | S | 650 |
| 1 | 20 | West | SK | 850 |
| 1 | 20 | Rel | T | 825 |
| 7 | 15 | GE | RC | 850 |
| 2 | 15 | West | SK | 850 |
| 1 | 15 | West | SK | 1150 |
| 6 | 15 | Rel | T | 850 |

Quantity of small sizes from ½ to 10 H.P. in addition to those listed.

### ★ MOTORS

1—268 HP G.E. Sync. 2300-3-60-600
3—100 HP G.E. Sq.C. 2300-3-60-720
3—75 HP G.E. Sq.C. 2300-3-60-900
4—75 HP G.E. Sq.C. 2300-3-60-720
2—60 HP G.E. Sq.C. 2300-3-60-900
2—50 HP G.E. Sq.C. 2300-3-60-900
2—35 HP G.E. Sq.C. 2300-3-60-900
2—15 HP G.E. Sl. Rg. 550-3-60-900
1—25 HP G.E. Sl. Rg. 550-3-60-900
1—30 HP G.E. Sl. Rg. 220-3-60-900
2—20 HP G.E. Sq.C. 220-3-60-1200
2—75 HP G.E. Syn. Motors, 900 RPM, 220 volt, 3 phase, 60 cycle, with direct connected exciters and compensator.

### ★ TUBES

9,000 Condenser Tubes 1" OD 20 Gauge Admiralty 18 ft., long like new

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ROCHESTER NEW YORK

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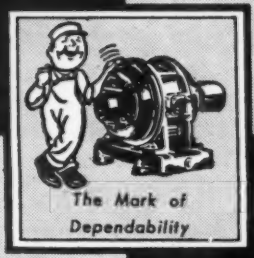


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33 N. SUPERIOR ST.
TOLEDO OHIO

## TRANSFORMERS

4—500 KVA Gen. Elec. Type H form KDD, 60 cy. Single phase, Primary 6900V or 11950 Y; secondary 2300V—with primary taps—circular coil H design.

6—150 KVA Gen. Elec. type H 2200/220/440 25 cy. single phase.

1—200 KVA Allis Chal. 60 cy. 3 ph., 220/440.

1—300 KVA Gen. Elec. 60 cy. 3 ph., 220/440.

## ALTERNATORS

200 KVA Gen. Elec. Ft. Wayne 3 ph., 60, 220/440, 720 RPM. revolving field.

150 KVA Gen. Elec. Type ATB form D, 60, 3 ph., 220/440 600 RPM., revolving field, built-in exciter.

## D. C. GENERATORS

150 KW Western Elec. 3 big, 3 wire, 150/230 V, 600 RPM.

50 KW Milwaukee, Comp. Wound 125 V, 600 RPM.

## FREQUENCY CHANGERS

All sizes, voltages and cycles.

## ★ 400 H.P. SYNCHRONOUS MOTOR ★

**Complete A.C. Synchronous Motor**

**1—400 H.P. Wsghse Syn. motor, 3 ph, 60 cy 4000/2300 V, 400 RPM with built-in magnetic clutch. Complete panel mounted reduced voltage type Starting Control. Motor-Generator Set—factory built for excitation and clutch operation. 10 KW, 125 V, DC 1750 RPM, Type SK63, Wsghse, with direct conn. 15 HP, Type CS, 3 ph, 60 cy, 220/440 V.**

## 3 ph. 60 cy. A. C. MOTORS

| H.P. | Make | | Type | | Speed | Volts |
|---|---|---|---|---|---|---|
| 300 | Gen. Elec. | Sl. Rg. | I Form M | | 600 | 220/440 |
| 220 | Gen. Elec. | Synch. | ATI dir. conn. Ex. 8 PF | | 600 | 220/440 |
| 200 | Wsghse. | Sl. Rg. | CW | | 900 | 220/440 |
| 200 | Gen. Elec. | Sq. Cg. | I Form K | | 514 | 220/440 |
| 175 | Ideal | Sl. Rg. | AVA | | 1750 | 2200 |
| 150 | Gen. Elec. | Sq. Cg. | I | K | 600 | 2300 |
| 150 | Burke | Sq. Cg. | 3 big | 2 ph | 900 | 220/440 |
| 125 | Gen. Elec. | Sq. Cg. | I | K | 720 | 220/440 |
| 100 | Gen. Elec. | Sq. Cg. | I | K | 720 | 2200 |

## 3 ph. 25 cy. MOTORS

| H.P. | Make | | Type | Speed | Volts |
|---|---|---|---|---|---|
| 200 | Wsghse. | Sl. Rg. | CW | 485 | 220/440 |
| 200 | Gen. Elec. | Sl. Rg. | I Form M | 485 | 220/440 |
| 150 | Gen. Elec. | Sl. Rg. | I Form M | 500 | 2200 |
| 150 | Gen. Elec. | Sl. Rg. | I Form M | 750 | 2200 |
| 100 | Wagner | Sl. Rg. | BR | 750 | 220/440 |
| 100 | Gen. Elec. | Sl. Rg. | I Form M | 750 | 220/440 |
| 100 | Wsghse. | Sq. C. | CS | 500 | 220/440 |
| 75 | Wsghse. | Sq. C. | CC6 | 500 | 220/440 |
| 75 | Triumph | Aut. Start | | 750 | 220/440 |
| 75 | Wagner | Sq. C. | BM | 750 | 2200 |

## 230 V DC MOTORS

| H.P. | Make | Type | Speed |
|---|---|---|---|
| 150 | Burke | Comp. Inter. ph. | 450/700 |
| 105 | Gen. Elec. | CL-6 Shunt Wound | 700 |
| 100 | Northwestern | K30 Comp. Inter. ph. | 1750 |
| 100 | Wsghse. | SK143 Shunt Inter. ph. | 1750 |
| 85 | Gen. Elec. | Vert. Comp. Wound | 700 |
| 40 | Fair. Morse | Ball big. Vert. Comp. | 1740 |
| 32 | Sturdevant | C Form P. Shunt Wound | 190 |

***Only partial listing—Write or wire your inquiries***

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**TURRO UNITS—60 Cy.**

1—12000 KW General Electric Cond.
1— 6250 KVA General Electric Cond.
1— 4000 KW General Electric Cond.
1— 4000 KVA Allis Chalmers Cond.
1— 3125 KVA General Electric Cond.
1— 2850 KVA Westinghouse Cond.
1— 1250 KVA General Electric Cond.
1— 937 KVA General Electric Cond.
1— 750 KVA General Electric Cond.
1— 750 KVA Terry Double Extr. Cond.
1— 375 KVA General Electric Cond.
1— 250 KVA General Electric Cond.
1— 938 KVA West. 375# I.P. 100# B.P. N-C.
1— 937 KVA Moore-Allis N-C. Bleeder
1— 312 KVA Moore Non-Condensing
1— 250 KVA Westinghouse Non-C.
1— 200 KW Elliott Non-Condensing
1— 125 KVA Moore Non-Condensing
1— 125 KVA Westinghouse Non-C.
1— 63.5 KVA Westinghouse Non-C.

**STEAM ENGINE UNITS—60 Cy.**

1—1067 KVA Nordberg Uniflow
2— 937 KVA Nordberg Uniflow
1— 500 KVA Rice & Sargent Corliss
1— 325 KVA Skinner Uniflow
1— 300 KVA Hamilton 4-valve
1— 250 KVA Harrisburg Uniflow
1— 150 KVA Hamilton Poppet Valve

**DC STEAM ENGINE UNITS**

1—500 KW Skinner Uniflow 250 V.
1—350 KW Ridgway 4-valve 250 V.
1—300 KW Skinner Uniflow 250 V.
1—300 KW Erie City 4-valve 250 V.
1—200 KW Chuse 4-valve 250 V.
1—150 KW Erie Ball 4-valve 250 V.
1—150 KW Ames Uniflow 125 V.
1—100 KW Ames Uniflow 120 V.
1—100 KW Elliott 4-valve 250 V. 3-wire
1— 75 KW Skinner Uniflow 250 V.
1— 50 KW Ames Uniflow 125/250 V. 3-wire

**OIL & GAS ENGINE UNITS—60 Cy.**

1—1000 KVA Cooper (gas) 240 V.
1— 720 KW McInt.-Seymour 2300 V.
1— 400 KW West. (gas) 440 V.
1— 300 KVA Fair.-Morse 2400 V.
1— 187 KVA McInt.-Seymour 2300 V.

**WATER TUBE BOILERS**

4—1000 HP Heine 250-lb. Oil Fired
1—1000 HP Edge Moor 200-lb Stokers
1— 800 HP Connelly 250-lb. Stoker
4— 750 HP Edge Moor 200-lb.
2— 633 HP Bigelow Hornsby 225-lb.
6— 600 HP Stirling 180-lb. Stokers
2— 520 HP Heine 200-lb. Hand Fired
1— 512 HP Stirling 200-lb. Stoker
2— 490 HP Stirling 200-lb.
8— 400 HP Stirling 200-lb.
1— 400 HP B. & W. 160-lb. Stoker
2— 350 HP Stirling 200-lb.
2— 302 HP B. & W. 200-lb. Hand Fired
2— 282 HP Edge Moor 200-lb. Stokers

**SYNCHRONOUS MOTORS—60 Cy.**

2—800 HP Electric Machy. 6600 V. 450 RPM
1—400 HP Allis Chalmers 2300 V. 600 RPM
1—290 HP Allis Chalmers 2300 V. 600 RPM
1—200 HP General Electric 2200 V. 1800 RPM
1—175 HP General Electric 230 V. 225 RPM
1—175 HP General Electric 220 V. 200 RPM
1—150 HP General Electric 440 V. 164 RPM
1—100 HP General Electric 2300 V. 240 RPM

**INDUCTION MOTORS—60 Cy.**

4—3500 HP G. E. slip ring 2300 V. 120 RPM
2— 800 HP G. E. slip ring 2300 V. 300 RPM
2— 400 HP G. E. slip ring 3800 V. 1800 RPM
2— 300 HP G. E. sq. cage 440 V. 600 RPM
2— 250 HP G. E. sq. cage 4000 V. 1200 RPM
1— 250 HP G. E. slip ring 2200 V. 450 RPM

**AIR COMPRESSORS**

1—2100 Ft. 65-lb. Worth. 60 cy. motor
1—1300 Ft. 100-lb. Sullivan Diesel
1—1300 Ft. 100-lb. Ing. XPV steam driven
1—1200 Ft. 100-lb. Ing. 2-stage, belt driven
1—1052 Ft. 100-lb. XRE, 60 Cy. motor

**OIL CIRCUIT BREAKERS**

1— 800 A. 87 KV Am.Br.Bov. AF22 Outdoor
2— 600 A. 73 KV West. G222AS Outdoor
1— 400 A. 73 KV G. E. FKO-36 Outdoor
2— 600 A. 37 KV Condit FO40A Outdoor
4— 400 A. 34.5 KV Condit D-16-A Outdoor
2—1000 A. 30 KV Kelman CB-76 Outdoor
4— 600 A. 25 KV West. CO-2 Outdoor
1— 400 A. 25 KV G. E. FKO-136 Outdoor
2— 600 A. 15 KV Kelman CB-76 Outdoor
4— 600 A. 15 KV G. E. FKO-60-B Outdoor

**FREQUENCY CHANGERS**

2—3125 KVA West. 25/62½ cy. 750 RPM
1—3000 KVA G. E. 60/25 cy. 300 RPM
1—2500 KVA West. 25/60 cy. 300 RPM
1—1500 KW G. E. 25/60 cy. 300 RPM
1—1000 KVA G. E. 60/25 cy. 514 RPM
1— 750 KVA G. E. 25/60 cy. 300 RPM

**ROTARY CONVERTERS—60 Cy.**

1—1000 KW Westinghouse, 600 V.
1— 750 KW Westinghouse, 600 V.
1— 500 KW General Electric, 250 V.
1— 500 KW General Electric, 600 V.
2— 300 KW General Electric, 600 V.

**SYNCHRONOUS CONDENSERS**

1—4000 KVA G. E. 13200 V. 514 RPM
1—2000 KVA G. E. 11000/2200 V. 720 RPM
1—2000 KVA C. W. 11000 V. 600 RPM
1—1000 KVA G. E. 2300 V. 900 RPM
1— 500 KVA West. 2200 V. 900 RPM

**TRANSFORMERS—1 Ph. 60 Cy.**

3— 600 KVA West., 120,000/2300 V.
1— 500 KVA Allis, 72000/6600 V. 3 ph.
3— 500 KVA West., 66000/2400 V.
3— 500 KVA West., 33000/2400-4152 V.
3— 500 KVA Allis, 33000/480 V.
6— 250 KVA Penn., 34500-17250/4600-2300 V.
1—10000 KVA G. E., 26400 Y/2300 V. 3 ph.
3— 1500 KVA Pitts., 22000/6600 V.
2— 1000 KVA G. E., 23000-11500/575 V.
3— 833 KVA West., 22000/2300 V.
4— 667 KVA West., 22000-11000/2300 V.
3— 250 KVA G. E., 22000/11000 V.
1—10000 KVA Pitts., 13200/4600 V. 3 ph.
2— 5000 KVA American, 13800/2300 V.
1— 450 KVA G. E., 13200/240-480 V. 3 ph.
3— 150 KVA Pitts., 13800/230-460 V.
3—1000 KVA Packard, 11000/2300-4000 V.
3— 150 KVA Pitts., 11000/2400 V.
3— 100 KVA West., 11000/250-125 V.
3—1250 KVA G. E., 6600/550 V.
3—1000 KVA Pitts., 2300-4600/550 V.
2— 333 KVA Pitts., 2400/220 V.
6— 100 KVA Pitts., 2300/575 V.

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**AC TURBINE UNITS**

6250 KVA G.E. 2300 V. cond.
4000 KVA Al. Chal. cond.
3125 KVA G.E. 2300 V. cond.
2500 KVA G.E. 2300 V. cond.
1875 KVA Al. Chal. 2300 V. cond.
1250 KVA (2) G.E. 2300/4000 V. cond.
1000 KVA Wghse., 2 ph., 600 V., cond.
**937 KVA G.E. 2300/600 V., Non-Cond.**
937 KVA G.E., 2300 V., 550° cond.
937 KVA Al. Chal.-Kerr 480/240 V. Non-cond.
937 KVA Al. Chal. 408 V.—Moore Non-Cond. and bleeder.
**937 KVA Al. Chal.—Elliott, 480/240 V., cond. or mixed pressure; with Jet Condenser, etc.**
**780 KVA Al. Chal. 2300 V., with Surface Condenser, Radio-Air Ejectors, etc. New, never in service.**
780 KVA Al. Chal.-Terry 3-600 v. bleeder.
625 KVA Wghse. 2300 V.
625 KVA Al. Chal. 2 ph., 2400 V.
**625 KVA G.E. 2300 V.; Bleeder; Condenser.**
625 KVA Wghse. 2300 V. Non-Cond.
625 KVA Al. Chal.-Kerr 240/480 V. Non-Cond.
**625 KVA Al. Chal.—Elliott, 240/480 V., Automatic Bleeder, with Jet or Surface Condenser.**
625 KVA Wghse. 2400 V.
375 KVA G.E. 2300 V., non-cond.
375 KVA Al. Chal. 2 ph., 2400 V.
375 KVA G.E. 2300 V., Bleeder.
312 KVA Ridgeway-Elliot 480/240 V., with Jet Condenser. Condensing or Mixed Pressure.
150 KVA Wghse. 240/480 V.
75 KVA Al. Chal. 240-440 V., non-cond.

**BLEEDER TURBINE UNIT**

**625 KVA Allis Chalmers-Elliott 3 ph. 60 cy. 240/480 v.; automatic bleeder; with jet or surface condenser**

**AC ENGINE UNITS**

375 KVA G.E. 22x27 Erie Ball 4 V.
250 KVA G.E. 17x20 Erie Ball 4 V.
225 KVA G.E.—18x36 Hamilton Corliss.
187 KVA G.E.—18x21 Chuse Uniflow.
150 KVA (2) G.E.—16x16 Skinner Uniflow.
125 KVA G.E. 14x15 Skinner Uniflow.
112 KVA G.E. 14x18 Erie Ball 4 V.
100 KVA G.E. 14x16 Skinner Uniflow.

**BOILERS (ASME)**

749 HP Edgemoor 200 lbs.
638 HP Bigelow Hornsby, 225 lbs.
500 HP Murray (Heine) 200#
420 HP Sterling, 200#
320 HP Sterling, 200#
302 HP Babcock & Wilcox, 200#
**295 HP (3) Sterling, 200#**
253 HP (2) Heine, 160#—cross drum.

**GAS & DIESEL UNITS**

1000 KVA G.E. 3 ph. 60 cy.; with Cooper Bessemer Nat. Gas. Engine.
375 KVA Wghse. 3 ph. 60 cy.; Busch-Sulzer.
312 KVA Burke 3 ph., 6 cy. with Anderson Diesel.
219 KVA G.E. 3 ph. 60 cy.; Worthington.
200 KVA G.E. 3 ph. 60 cy.; Busch-Sulzer.

**ENGINE (Steam)**

20x21 Skinner Uniflow, belted, 175 lbs. (15 to 25 lbs., b.p.)

**TRANSFORMERS (3 Phase)**

5—1800 KVA G.E. 14,520/11,400-600/480 V.
3—1050 KVA G.E. 11,000/22,000-445 V.
1— 300 KVA Mal. 13,200/6600-220/440 V.
5— 150 KVA Mal., 4160/2400-800-400 V.
1— 150 KVA G.E. 13,800-230/460 V.
1— 150 KVA Wagner, 13,860-110/220 V.
1—100 KVA Wagner, 13,860-220/110 V.

**TRANSFORMERS (Single Phase)**

7—1667 KVA G.E. 43,350/75,000-2300 V.
4—1250 KVA Wghse., 32,500/12,000-2300/4000 V.
4— 750 KVA Wghse., 36,440/63,000-6900 V.
2— 687 KVA Maloney 13,800-460 V.
3— 500 KVA Wghse., 66,000/33,000-2400 V.
3— 500 KVA Wghse., 22,000-2200 V.
2— 500 KVA Maloney, 2200-220 V.
6— 300 KVA Pitts., 22,000-2200-440 V.
2— 250 KVA G.E. 6600-2300 V.
6— 250 Penn. 34,500/17,250-4600/2300 V.
3— 250 KVA Packard 22,000-2300 V.
1— 200 KVA G.E. 13,800-230/460 V.
1— 200 KVA Wghse. 11,200-2300/4000 V.
4— 200 KVA G.E. 13,200-2300 V.
4— 150 KVA G.E. 2300/4000-115/230 V.
3— 150 KVA Wghse. 11,000-440 V.
3— 150 KVA G.E. 13,200-115/230 V.
3— 100 KVA G.E. 2200-220 V.
3— 100 KVA G.E. 13,200/6600-2300 V.
2— 100 KVA G.E. 600-120/240 V.
2— 100 KVA G.E. 13,800-115/230 V.
3— 100 KVA Kuhl, 13,200-2300 V.
3— 100 KVA Al. Chal. 22,000-440 V.
3— 100 KVA G.E. 13,200-4000/2300/460 V.

SEARCHLIGHT SECTION

## Here's the Power Plant You Want To Meet The Emergency!

# MODERN STEAM GENERATING and ELECTRIC PLANT

WILMINGTON, DELAWARE

★ *Complete in Every Detail* ★

*Right Down to the Last Valve*

## Shut Down Dec. 10, 1942 — Can Be Used Immediately

### ★ BOILER PLANT

2—633 H.P. Bigelow & Hornsby Water-Tube Boilers, ASME Code, insured for 225 lbs. working pressure in 1942. Equipped for wood-waste and also oil firing. Including: Jungstrom Pre-Heater, Carling Turbine driven Fan, Super Heaters, Soot Blowers.

2—Turbine driven Centrifugal Feed Water Pumps
Sims Size A Feed Water Heaters
Permutit Water Treatment Plant
All inter-connecting piping, valves, etc.

### ★ POWER PLANT

1—750 KW, 3600 RPM, Type T-B-3 multi-stage bleeder type Moore Turbine, designed for steam operation at 190 lbs. gauge at the throttle, and 100 deg. superheat, to exhaust against back pressure of 10 lbs. and to bleed 50,000 lbs. of steam per hour at 75 lbs. pressure. Direct connected to—

1—750 KW Allis-Chalmers Generator, 3/60/480 volts, Shop No. 122033, with direct connected exciter. Complete with six-panel switchboard and instruments, all inter-connecting piping, and set up as operated.

This complete plant is still set up as operated and complete with all interconnecting piping, fittings, and all auxiliaries. This plant was shut down December 10, 1942 due to lack of raw materials. Complete plant can be moved immediately.

**ARRANGE TO INSPECT**

★ ★ ★ ★ ***Telephone or Wire at once to*** ★ ★ ★ ★

# CONSOLIDATED PRODUCTS CO., INC.

**14-17 PARK ROW** **NEW YORK CITY, N. Y.**

**Telephone BArclay 7-0600**

# MOTORS • GENERATORS • TRANSFORMERS

## Prices on Application

**3 PHASE, 60 CYCLE, 220/440 V.**

| HP | Make | RPM | Type | Frame |
|---|---|---|---|---|
| 5 | West. | 1200 | CCL | 2 phase |
| 5 | American | 600 | totally enc. | ball bearing |
| 7½ | Gen. Elect. | 1800 | KT | 944 |
| 7½ | Gen. Elect. | 1800 | KQ | 944 2 phase |
| 10 | Fairbanks Morse | 900 | KBY | |
| 10 | Crocker Wheeler | 900 | Nema | 365 |
| 10 | Burke | 1800 | | |
| 15 | Reliance | 1200 | | 2 phase |
| 15 | Howell | 900 | | 2 phase |
| 20 | Gen. Elect. | 1800 | KQ501 | 2 phase |
| 20 | Gen. Elect. | 565 | I | Form K |
| 25 | Gen. Elect. | 1740 | KQ312 | 2 phase |
| 25 | Armor | 1200 | ball bearing | 2 phase |
| 25 | Gen. Elect. | 1800 | KT | 312 |
| 30 | Gen. Elect. | 3600 | KT | 513 |
| 30 | Armor | 695 | pail bearing | 2 phase |
| 50 | West. | 1200 | MS | |
| 50 | Fairbanks Morse | 1800 | ball bearing | |
| 50 | Fairbanks Morse | 1800 | ball bearing | |
| 50 | West. | 1800 | CS | |
| 60 | Gen. Elect. | 1800 | I | form K |
| 75 | Gen. Elect. | 1800 | I | form K |
| 75 | Gen. Elect. | 900 | KT | 552 |
| 100 | Gen. Elect. | 1800 | I | form K |
| 100 | West. | 1800 | CS | |
| 150 | Gen. Elect. | 1200 | I | form K |
| 150 | Gen. Elect. | 1200 | I | form K |

### MOTOR GENERATOR SETS

1—100 KW Ridgeway sets 250 v. DC. 1200 RPM direct connected to 150 HP. Ridgeway synchronous motors, 3/2200/60/1200 complete with panels.

1—100 KW. Crocker Wheeler 250 v. DC 500 RPM direct connected to 150 HP General Electric Motor 3 PH 25 cycle 2200 volts 500 RPM, complete.

1—75 KW Ridgeway 140 v. DC 1200 RPM direct connected to 120 HP Ridgeway synchronous motor 3/2200/60/1200 RPM. Complete.

1—35 KW Westinghouse Generator 125 volt DC 1450 RPM direct connected to 53 HP West. CS motor 3 ph. 25 cy. 220 v. 1450 RPM. complete.

## WANTED

***Write—Wire—or Phone***

1—125 or 150 H.P. 230 Volt D.C. Motor. 200/1200 RPM. or any 6—1 ratio. Wire if you have this motor.

### SLIPRING MOTORS

**60 CYCLE, 3 PHASE, 220/440 VOLTS**

| HP | Make | Speed | Type | Frame |
|---|---|---|---|---|
| 10 | Gen. Elect. | 1800 | MT | 303 |
| 15 | Gen. Elect. | 1800 | I | form M |
| 20 | Gen. Elect. | 545 | MT | 332 |
| 20 | Westinghouse | 575 | CW | 648A |
| 20 | Westinghouse | 575 | CW | ball bearing |
| 25 | Westinghouse | 690 | CW | |
| 30 | Gen. Elect. | 1800 | MT | 327 |
| 30 | Gen. Elect. | 1800 | I | form M |
| 40 | Westinghouse | 690 | CW | 748 |
| 40 | Westinghouse | 690 | CW | 748A |
| 40 | Westinghouse | 690 | CW | 748A |
| 40 | Westinghouse | 690 | CW | 748A |
| 50 | Westinghouse | 900 | CW | |
| 60 | Westinghouse | 720 | CW | 2200 volt |
| 75 | Westinghouse | 1800 | CW | |
| 300 | Gen. Elect. | 1200 | I | form M |
| 500 | Westinghouse | 600 | CW | |

### TRANSFORMERS

| Amt. | Kva. | Make | Cycle | Voltage |
|---|---|---|---|---|
| 21 | 25 | G.E. | 25 | 2300/230/460 |
| 6 | 40 | G.E. | 5 | 2300/230/460 |
| 6 | 30 | G.E. | 25 | 2300/115/230 |
| 24 | 50 | G.E. | 25 | 2300/230/460 |
| 3 | 50 | Packard | 25 | 6900/230/460 |
| 18 | 50 | G.E. | 60 | 4160/4600/230/460 |
| 3 | 75 | 60 | 60 | 4160/4600/230/460 |
| 18 | 100 | G.E. | 60 | 4160/4600/230/460 |
| 3 | 100 | Kuhlman | 25 | 2300/230/460 |
| 3 | 200 | G.E. | 60 | 2300/230/460 |
| 3 | 200 | G.E. | 60 | 6900/230/460 |
| 3 | 200 | Kuhlman | 60 | 4160/4600/230/460 |
| 3 | 500 | Pitts. | 25 | 11500/220 |
| 3 | 1000 | Pitts. | 60 | 2300/4600/230/460 |

## Prices on Application

**3 PHASE, 25 CYCLE, 220/440 VOLTS**

| HP | Make | RPM | Type | Frame |
|---|---|---|---|---|
| 50 | Gen. Elect. | 750 | I | form K |
| 50 | Westinghouse | 750 | CS | |
| 75 | Gen. Elect. | 750 | KT | 357 |
| 75 | Gen. Elect. | 750 | I | form K |
| 100 | Gen. Elect. | 750 | I | form K |
| 100 | Gen. Elect. | 300 | 117 | form K |
| 150 | Gen. Elect. | 750 | I | form K |
| 150 | Gen. Elect. | 750 | I | form K |
| 200 | Westinghouse | 460 | CS | 2200 volt |
| 200 | Gen. Elect. | 750 | I | form K |
| 225 | Elec. Machinery | 500 | 2200 volt synhronous | |
| 1150 | Gen. Elect. | 375 | 2300 volt synchronous | |
| 200 | Westinghouse | 235 | CW | slipring |

### SPECIAL MOTORS

1100 H.P. General Electric Synchronous Motor, 3 ph., 25 cy., 11,500/6600/2200 V., 375 RPM.

500 H.P. Allis-Chalmers, 3 ph., 25 cy., 440 V., 490 R.P.M., Complete.

300 H.P. G.E. Slipring, 25 cy., 3 ph., 2200 V., 500 RPM, 3 bearing; complete with controls.

225 H.P. Electric Mchy Co. Synchronous, 3 ph., 25 cy., 2200 V., 500 R.P.M. with controls.

1—100 H.P. G.E. Synch. Motors, 3 ph., 25 cy., 220/440 V., with control equipment.

1—20 HP. Gen. Elec. Motor 230 v. DC. Type CD83 1750 RPM.

1—75 HP. Westinghouse Motor Type SK, 230 v. DC 475/950 RPM variable speed.

### FREQUENCY CHANGERS

2—1250 KVA Gen. Elec. Synchronous—motor 3/25/2200 750 RPM. direct connected to Generator 3/62½/440 V. Complete with exciters and panels.

1—200 KW General Electric 3 ph., 60 cy., 2300 V. direct connected to 290 HP. Gen. Elec. Synchronous Motor, 3 ph., 25 cy., 440 volt, 750 RPM. Complete with panels.

1—120 KVA Gen. Elec. Induction Frequency Changer, 440 V., 3 Phase, 62½ Cycle. Driving motor 100 H.P., 3/25/440/720 RPM. Complete.

94 KVA Westinghouse Synchronous Set Generator, 63¾ cy., 230 v., 750 RPM with panels. Motor 112 HP. 3/25/2300/750 Synchronous with starting equipment.

# ERIE ELECTRIC CO., INC.

**124 CHURCH ST. BUFFALO, N. Y. CL. 4758**

# Let MacCABE lift your Worries!

### OVERHEAD ELECTRIC TRAVELING CRANES

| Tons | Make | Span | Current |
|---|---|---|---|
| (2)-1 | Maris | 35′ 7″ | 230-VDC. FL. OP. |
| (2)-1½ | Euclid | 30′ 0″ | 115/230-VDC. FL. OP. |
| (1)-2 | P & H | 34′ 8″ | 230-VDC. CG. OP. |
| (2)-3 | Sprague | 20′ 6″ | 115/230-VDC. FL. OP. |
| (2)-3 | Armington | 12′ 4″ | 230-VDC. CG. OP. |

(Sprague & Armington Cranes Underslung Type with Overhang)

| | | | |
|---|---|---|---|
| (1)-5 | Shep. Niles | 30′ 0″ | 230-VDC. |
| (1)-5 | Cleveland | 34′ 3″ | 230-VDC. |
| (1)-10 | Whiting | 32′ 0″ | 220-V-3-PH-60-CY. |
| (1)-20 | P & H | 50′ 0″ | 230-VDC. |
| (1)-40 | P & H | 50′ 0″ | 230-VDC. |

### 230-VDC. CRANE & MILL MOTORS

| H.P. | Make | Type | R.P.M. |
|---|---|---|---|
| (1) | P & H | 5¼ x 3½ | 850 |
| (1) 2½ | G.E. | C.O. 2502 | 800 |
| (1) 3½ | G.E. | C.O. 2503 | 800 |
| (1) 2 | Shaw | B.E. | 930 |
| (1) 2½ | Rel. | T | 1600 |
| (8) 2¼ | Westg | K-1 | 835 |
| (3) 6 | G.E. | C.O. 1805 | 1150 |
| (2) 7½ | Westg. | MT-000 | |
| (1) 8 | Shaw | Z- #62 | 640 |
| (1) 10¾ | C.W. | #6-K | 810 |
| (9) 20/30 | G.E. | M.D. 104 | 725/575 |
| (2) 19 | Westg. | K-5 | 550 |
| (14) 30/45 | G.E. | M.D. 104½ | 625/500 |
| (2) 50 | Shaw | Z | 550 |
| (2) 50 | G.E. | C.O. 1810 | 550 |
| (1) 60 | Westg. | K-10 | 470 |
| (3) 65/85 | G.E. | C.O. 1830 | 700/650 |
| (2) 55/65 | Westg. | MCA- #60 | 550 |
| (2) 65/85 | G.E. | C.O. 1811 | 700/550 |
| (1) 60/80 | G.E. | M.D. 106 | 550/475 |
| | (With Back Axle Brackets) | | |
| (1) 100 | G.E. | C.O. 1812 | 700 |
| (1) 150 | Westg. | MCB | 365 |

Complete Resistors & Drum Controllers with Above G.E.M.D. Motors, Also 75 E. C. & M. Dinky, C.H., G.E., & Westgshe Drum Controllers in Stock 5 to 100-HP.

### ELECTRIC TRAVELING GANTRY CRANES

(1)-3-ton Milwaukee 3-motor, A.C. or D.C., 31′ 3″ span, 13′ 3″ overhand each side.

(1)-15/5-ton McMyler, 4-motors, A.C. or D.C., 80′ 0″ span, 35′ 0″ lift.

(1)-50-ton Morgan, 5-motors, (2-25-ton trolleys), 60′ 0″ span, 50′ 0″ overhang each end.

### GENERAL PURPOSES 230-VDC. MOTORS

| H.P. | Make | Type | Speed |
|---|---|---|---|
| (2) 2 | Al. Ch. | #50 DE | 1750 |
| (1) 3 | Rel. | T-224 | 3500 |
| (1) 3 | G.E. | RLC-111 | 500/1500 |
| (4) 5 | Westg. | SK- #40 | 850 |
| (1) 5 | Westg. | SK- #33 | 1150/1650 |
| (3) 7½ | Westg. | SK-83&103 | 400/1600 |
| (4) 7½ | Westg. | SK- #60 | 850 |
| (1) 7½ | Westg. | SK- #40 (110-V) | 1150 |
| (1) 8 | Westg. | SK-100 | 300/1200 |
| (1) 10 | Westg. | SK-50 | 1300 |
| (2) 10 | Westg. | SK-70 | 850 |
| (1) 10 | Westg. | SK | 400/1600 |
| (1) 15 | Rel. | 21-OT | 300/1200 |
| (1) 25 | Westg. | SK | 1100 |
| (1) 70 (New) | Rel. | 46-I.T. | 600/1200 |

(New E. C. & M. Auto. Panel)

### SLIP RING MOTORS

| H.P. | Make | Type | Current |
|---|---|---|---|
| (2) 5 | G.E. | MTC-5200 | 220/3/60 |
| (1) 5 | G.E. | MTC-5201 | 220/3/25 |
| (1) 15 | G.E. | ITC-5008 | 220/3/60 |
| (2) 15 | G.E. | ITC-5009 | 220/3/60 |
| (1) 15 | G.E. | MTC-5302 | 440/3/60 |
| (3) 22 | G.E. | ITC-5009 | 220/3/60 |
| (2) 22 | G.E. | ITC-5010 | 220/3/60 |
| (1) 25 | G.E. | MQC-5526 | 220/2/60 |
| (1) 25 | Westg. | C.I. | 220/2/60 |
| (2) 35 | Westg. | C.I. | 220/2/60 |
| (2) 37 | G.E. | ITC-5011-A | 220/3/25 |
| (1) 40 | G.E. | ITC-5012 | 220/3/60 |
| (1) 52 | G.E. | ITC-5013 | 220/3/60 |

(Many of these equipped with Electric Brakes. We can furnish Drum Type Controllers from Stock.)

# T. B. MacCABE COMPANY

**4306 CLARISSA STREET PHILADELPHIA, PA.**

# SEARCHLIGHT SECTION

## 500 KW WESTINGHOUSE M G SET

**Late Type 500 KW Westinghouse Syn. Motor Generator Set**

**Motor—714 HP 3 ph. 60 cycle 4100 Volts 900 RPM 80% PF 900 RPM**

**Generator—500 KW 250/125 Volts 2000 Amps 900 RPM. Complete with Manual AC & DC Controls**

**150 KW General Electric, 250 volts motor generator set, 900 RPM, 3 phase, 60 cycle, 2300 volts.**

## 35 KVA—40/90 CY. GEN.

**35 KVA West. MG Set Motor:—40/90 HP. Type SK 230V, 800/1800 RPM.**

**Generator:—35 KVA 3 ph., 40/90 cy. 115 volts, 800/1800 RPM. Late type Factory built.**

### SYNCHRONOUS MOTORS

200 H.P. G.E.—TS—514 RPM.
55 H.P. Elec. Machy., 1200 RPM.

### SLIPRING MOTORS

500 H.P. A-C—1500 RPM.
250 H.P. G.E., 600 RPM.
200 H.P. G.E., 720 RPM.
200 H.P. G.E., 514 RPM.
125 H.P. Burke, 600 RPM.
75 H.P. West., 1200 RPM. (5).
64 H.P. G.E., 585 RPM.
60 H.P. West., 1200 RPM.
60 H.P. West., 290 RPM.
(180 additional slipring motors, 1 to 50 H.P. in stock.)

### SQUIRREL CAGE MOTORS

200 H.P. G.E., 600 RPM.
150 H.P. G.E., 600 RPM.
100 H.P. Cr.-Wh. 1800 RPM.
75 H.P. West. 1200 RPM.
60 H.P. G.E., 1800 RPM.
50 H.P. Allis Ch., 720 RPM.
50 H.P. G.E., 720 RPM.
50 H.P. G.E., 600 RPM.
(310 additional squirrel cage motors in stock, ¼ to 50 H.P.)

### A.C. GENERATORS

200 KW G.E., 600 RPM.
150 KW G.E., 900 RPM.
150 KW G.E., 720 RPM.
100 KVA Cr.Wheeler, 900 RPM.
100 KVA West., 600 RPM.
90 KW G.E., 900 RPM.

### 230 VOLTS D.C. MOTOR GEN. SETS

500 KW West. (see Box)
150 KW G.E. 900 RPM.
125 KW Curtis, steam turbine dr.
50 KW Burke, 1200 RPM.
25 KW G.E., 1750 RPM.
(18 additional sets in stock, 1 to 25 KW.)

### 125 V. MOTOR GEN. SETS

90 KW G.E.
75 KW Ridgway Syn. 1200 RPM.
50 KW West. 850 RPM.
(19 additional 125 V. M.G. Sets in stock, ½ to 25 KW.)

### 550 VOLT D.C. MOTORS

25 H.P. G.E., 875 RPM.
20 H.P. G.E., 895 RPM.
15 H.P. G.E., 2100 RPM. (2).
15 H.P. G.E., 1350 RPM.
7½ H.P. G.E., 900 RPM.
5 H.P. West., 1100 RPM.
3 H.P. G.E., 1800 RPM.
(12 additional motors in stock, ¼ H.P. up.)

### 230 VOLT D.C. MOTORS

165 H.P. Cr. Wheeler, 670 RPM.
100 H.P. Reliance, 1150 RPM. (2).
60 H.P. G.E., 1050 RPM.
60 H.P. G.E., 900 RPM.
60 H.P. Roth, 600 RPM.
50 H.P. G.E., 850 RPM.

### 230 VOLT D.C. MOTORS

40 H.P. El. Dyn., 1450/2600 RPM.
40 H.P. G.E., 1700 RPM.
40 H.P. Allis Ch., 1150 RPM.
40 H.P. Reliance, 625 RPM.
35 H.P. Ridgway, 300/800 RPM.
40 H.P. G.E., 440/800 RPM.
30 H.P. West., 500/1500 RPM.
25 H.P. G.E., 1150 RPM. (3).
25 H.P. West., 850 RPM. (2).
25 H.P. G.E., 575 RPM.
20 H.P. G.E., 1750 RPM.
(235 additional motors, ½ to 20 H.P. in stock.)

### 115 VOLT D.C. MOTORS

90 H.P. G.E., 900 RPM.
65 H.P. G.E., 550 RPM.
15 H.P. G.E., 1150 RPM.
10 H.P. L.A., 3600 RPM.
10 H.P. F.-M., 1150 RPM.
10 H.P. West., 850 RPM.
7½ H.P. G.E., 1750 RPM.
7½ H.P. West., 1150 RPM.
7½ H.P. G.E., 850 RPM.
(115 additional 115 volt D.C. Motors, ½ to 5 H.P., also in stock.)

### MISCELLANEOUS

5 H.P. B & D 230 volt buffer.
40—A.C. & D.C. Fans and Blowers
11—Motor Driven Freq. Changers 90 to 180 cycles.
14x10 Ing. Rand. Compressor, 503 ft. at 60 lbs. pressure.
12½x12 American Compressor, 390 ft. at 125 lbs. pressure.

# L. J. LAND AND COMPANY

**NEW YORK, N. Y.: 146 GRAND ST.**
**READING, PA.: 10TH AND EXETER STS.**

***New York City's largest stock Electrical Equipment***

**ONE YEAR GUARANTEE**

**We are actively in the market to purchase your surplus or idle electrical machinery.**

**OVER QUARTER CENTURY SERVING INDUSTRY**

## 250 VOLT ROTARY CONVERTERS

**1—1500 KW. Westinghouse compound interpole 250 V. D.C., 6 phase, 60 cycle AC Rotary converter, 600 RPM.**
**3 Single phase, 2300 Volt Transformers 1—DC and 1—AC panel for above.**

**2—1000 KW., Westinghouse compound interpole 250 volt DC, 6 phase, 60 Cycle AC Rotary Converter 900 RPM.**
**2—Banks of 3 Single phase, 2300 volt transformers for above and 2—DC and 2—AC panels.**

***The above in excellent condition.***

**The above are just a few of the thousand of items we have in Motors, Generators, Turbo Generators, Engine Generators, Motor Generators, Transformers, Circuit Breakers, etc. Please send us your inquiries. What have you for sale?**

**GEORGE SACHSENMAIER CO.**
**8403 Hegerman Street**
**Philadelphia, Pa.**

## SYNCHRONOUS CONVERTERS

**600 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM**
**600 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM**
**500 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM**
**300 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM**
**200 KW AL-CH. 250 D.C. 2300/4000 A.C. 1200 RPM**
**150 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM**
**150 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM**

## MOTOR GENERATORS

**300 KW G.E. SYN. 250 V. 2300/4000 A.C. 1200 RPM**
**300 KW G.E. SYN 250 V. 2300/4000 A.C. 720 RPM**
**250 KW G.E. SYN. 250 V. 2300/4000 A.C. 720 RPM**
**200 KW G.E. IND. 600 V. 2300 A.C. 1200 RPM**
**200 KW R.W. SYN. 250 V. 2300/4000 A.C. 900 RPM**

## TURBO GENERATOR SET

**300 KW GENERAL ELECTRIC-CURTIS, 250 V. D.C. Turbine, Non-Condensing, 100# Steam Pressure, 3600 RPM. GEN. ELEC. 300 KW, MPC Generator and D.C. Panel.**

***Each unit listed above is owned by us and is Available now for Immediate purchase.***

**WALLACE E. KIRK CO.**
**Incorporated**
**502 Grant Building Pittsburgh, Pa.**

## DIESEL ENGINES

### READY FOR IMMEDIATE SHIPMENT

2—450 H.P. Wintons, 8 cylinder, 4 cycle, 225 RPM, direct reversing.
2—300 H.P. Bessemers, 8 cylinders, 4 cycle, 650 RPM, direct reversing. With Steel Hull.
240 H.P. Superior, 6 cylinder, 4 cycle, 500 RPM.
240 H.P. Fairbanks-Morse, 4 cylinder, 250 RPM, direct reversing.
200 H.P. Fairbanks-Morse, 4 cylinder, 2 cycle, 257 RPM.
150 H.P. Fairbanks-Morse, 6 cylinder, 400 RPM, direct reversing.
150 H.P. Buda, 6 cylinder, 4 cycle, 980 RPM.
2—150 H.P. Wintons, 6 cylinder, 400 RPM, direct reversing.
2—140 H.P. Fairbanks-Morse, 4 cylinder, 400 RPM, direct reversing.
200 H.P. McIntosh-Seymour Diesel 135 K.W. D.C. Generator Set.
180 H.P. Worthington Diesel 100 K.V.A. Generator Set.
35 K.W. Hercules Diesel Generator Set, A.C.
25 K.W. Winton Diesel Generator Set, D.C.

**A. T. METTLER**
**151 Washington St. Brooklyn, N. Y.**
**Main 4-3804**

# SEARCHLIGHT SECTION

**SLIP RING MOTORS, 3 PH., 60-CY.**

| HP | Volts | Make | Speed |
|---|---|---|---|
| 700 | 2200 | G.E. | 900 |
| 400 (2) | 440 | Whse. | 514 |
| 380 | 220–440 | G.E. | 1800 |
| 360 | 2200 | G.E. | 600 |
| 300 | 2300–4000 | G.E. | 1200 |
| 282 | 440–550 | G.E. | 600 |
| 280 | 2200–550 | G.E. | 1800 |
| 200 | 2200–440 | G.E. | 600 |
| 180 | 440–220 | G.E. | 1800 |
| 180 | 2200 | G.E. | 900 |
| 180 | 2200–440 | Whse. | 1800 |
| 150 | 550–2200 | G.E. | 1800 |
| 125 | 440–220 | G.E. | 600 |
| 100 | 550–2200 | G.E. | 720 |
| 100 | 440–220 | G.E. | 1800 |
| 100 | 220–440 | G.E. | 720 |
| 100 | 220–440 | G.E. | 900 |
| 75 | 220–440 | G.E. | 600 |

**SYNCHRONOUS MOTORS, 3-PH., 60-CY.**

| | | | |
|---|---|---|---|
| 600 | 2200 | Whse. | 900 |
| 400 | 440–220 | Whse. | 276 |
| 350 | 440–220 | G.E. | 200 |
| 240 | 2300–440–220 | G.E. | 600 |
| 200 | 2300–4000 | G.E. | 1200 |
| 150 | 2200 | G.E. | 1800 |
| 100 | 440–220 | G.E. | 1200 |
| 50 | 220–440 | G.E. | 1200 |

**TRANSFORMERS—60 CYCLE**

3—667 kva., Whse. 22000-2300.
3—500 kva., Whse. 22000-2300.
3—400 kva., Al. Chal., type OISC 4150-2400.
3—350 kva., G.E., Type H-KD 13200-2300.
3—333 kva., G.E., type H-KDD 2400-460/230.
3—250 kva., Whse. 13,800-460.
3—200 kva., G.E., type H 10000-600.
3—200 kva., G.E., H-KD 6600-2300/4000Y., 25 cy.
3—175 kva. G.E. 4000-480.
3—150 kva., G.E., type H-KDD 13200-2300.
3—150 kva., Al. Chal., type OISC 10400-2400.
1—100 kva., Pittsburgh, type OISC 2400-240-120.
3—100 kva., G.E., type H 2400-240/480.
3—100 kva., G.E., type H-KDD, 6900/11950Y-230/115.
3—100 kva., Whse. 22,000-2300.
2— 75 kva., G.E., type HK, 2300-230/115.
3— 50 kva., Moloney, 2300-230/115.
6— 50 kva., Whse. type SK, 13800-240/120.
3— 50 kva., Whse. 22,000-2300.

**A. C. GENERATORS**

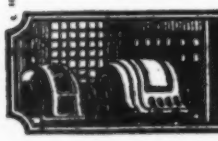
1—500 kva., 900 r.p.m., 2209 V. Whse. Condenser.
1—312 kva., 900 r.p.m., 2300 V., Westghse.
1—300 kva., 600 r.p.m., 240-480-V., G.E.
1—225 kva., 600 r.p.m., 2200-240-V., G.E.
1—187 kva., 900 r.p.m., 2200-550-V., Westghse.

**SQUIRREL CAGE MOTORS**

| HP | Volts | Make | Type | Speed |
|---|---|---|---|---|
| 500 | 440/220 | G.E. | IK | 1200 |
| 500 | 440/220 | G.E. | IK | 900 |
| 400 | 2200 | Whse. | C.S. | 1800 |
| 50 | 2200 | G.E. | IE-K | 1800 |
| 250 | 2200 | G.E. | I-K | 600 |
| 200 | 220/440 | G.E. | IK | 720 |
| 150 | 2200 | Allis. Ch. | AN | 450 |
| 100 | 2200 | G.E. | IK | 600 |
| 100 | 2200 | G.E. | IE-K | 1800 |
| 100 | 550 | G.E. | KT | 900 |
| 100 | 220/440 | G.E. | KT | 720 |
| 75 | 2200 | G.E. | KT | 900 |
| 75 | 2300 | G.E. | IE-K | 1800 |
| 50 | 220/440 | G.E. | K | 1800 |

**MOTOR GENERATOR SETS**

1—100 K.W., 250 V., 1200 R.P.M., Ridgeway, con. to 150 H.P., 2200 V., 3 ph., 60 cy., syn. motor.
1—75 K.W., 250 V., 1800 R.P.M., Cr. Wh., Type CCD con. to 100 H.P., 2200 V., 3 ph., 60 cy. Syn.
1—60 K.W., 125 V., 1200 R.P.M., G.E., type RC to 90 H.P., 4150/2300 V., 3 ph., 60 cy. syn.
1—50 K.W., 250 V., 720 R.P.M., Whse., Type SK con. to 75 H.P. 220/440 V., 3 ph., 60 cy. Sq.c.



## STEPHEN HALL & COMPANY, INC.

458 Seventh St., Hoboken, N.J.

**1—DC GENERATOR SET**

*Gasoline-driven*

Star Generator: 28 V, 400 amp. SB20 W
Engine: Buffalo, Type BA.
Complete with Panel.

**1—AC GENERATOR SET**

*Gasoline-driven*

Westinghouse Generator: 48 KVA, 3 phase, 120/240/480 V; 28 KVA, single phase, 120/240 V, 117 amp., 1800 rpm, 60 cyc., direct connected exciter.
Engine: Continental, 6 cylinder gasoline engine, complete with Switchboard with Circuit Breaker, Voltmeter, ammeter and Silverstat Regulator.

**Electric Apparatus Repair Co.**

1410-12 North Sixth Street Phila., Pa.

## YOUR OPPORTUNITY

1200 KW 325 lb. 3600 rpm Turbine only.
2500 KW G.E. 3/60/2300 V. Turbo Gen.
100 & 150 HP Diesel Generator Sets
150 HP Fairbanks Morse "Y" Oil Engines.
175 KW Nordberg Uniflow 3/60/2300 volt.
250 KW Nordberg Uniflow 3/60/220 volt.
200 KW 2300 V. Murray Corliss Generator.
200 KW 2300 V. Chase Corliss Generator.
450 KVA. 4000 volt "Y" Syn. Condenser.
200 KVA 257 rpm 3/60/440 V. Generator.
75 KVA 257 rpm 3/60/2300 V. Generator.
35 HP 2 Drum & Swinger Clyde Gas Hoist.
85 to 900 HP Steam Boilers 150/250 lb.

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*"New and Used — NOT Abused"!*

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*Phone—VanBuren 8669*

## STEAM GENERATING SET

125 KW 3 Phase, 440 Volts, direct connected to Chuse Horizontal Steam Engine, with Governor Switch Board, Exciter, etc.

## SYNCHRONOUS MOTORS

1—375 hp.—600 RPM 440 Volts—7% P.F. G.E. Type ATI 3 Bearing Synchronous Motors with Starters

**Reconditioned and Guaranteed**

*IMMEDIATE DELIVERY*

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Phone—Sutter 3943

# POWER PLANT EQUIPMENT

**TURBO-GENERATORS**

1—3000 KW G.E. 600 V. Cond.
1—2500 KW G.E. 2300 V. Cond.
1— 625 KW Terry-Allis—600 V. Cond.
1— 500 KW G.E. 240 V. Cond.
1— 500 KW G.E. 2300 V. Mixed P.
1— 500 KW G.E. 600 V. Cond.
1— 175 H.P. G.E. Turbine—only.

**AIR COMPRESSORS**

1—1214 Cu. Ft.—Sull Angle 100#.
1— 782 Cu. Ft.—IR—55#.
1— 599 Cu. Ft.—IR—2 stage Belted.
1— 146 Cu. Ft.—IR—3 stage Belted. 1200#.

**G.E. CENTRIFUGAL COMPRESSOR**

Type WM—675—8800/10800.
Volume—8800/10800 Pressure 32/39.6.
Driven by 820 H.P. G.E. Turbine.
Condition excellent.

**BOILERS**

4—1000 H.P. Heine 250#.
1— 60 H.P. HRT—125#

**BOILER FEED PUMP**

1—Duplex Steam—17"x10"x15".

**BELTED GENERATOR**

1—500 KW. G.E. 550 V. 225—RPM.

**INDUCED DRAFT FAN**

1—126,000 CFM to 210 HP Turbines.
1—165,000 CFM to 450 HP Turbine.

*Also transformers, engines and cranes*
*Send us your inquiries*

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The Buyer Must Be Satisfied—Always

1—Westinghouse CS, 500 HP, 450 rpm, AC meter. Needs rewinding. Will rewind to any speed and voltage within capacity of frame.
1—70 KW M-G Set, 250 volt DC, 2300/440/220-3-60 AC
1—50 KW M-G Set, 250 volt DC, 2300/4000-3-60 AC with switchboard.
Many transformers, motors, generators, etc.
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**JACKSON BAYLEY ELECTRIC CO.**

CANTON, OHIO

## DIESEL ENGINES

Large selection—All sizes and types. Generator units, marine engines, gasoline engines, auxiliaries —also boilers, steam engines, turbo generators.

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*WHAT DO YOU REQUIRE?*

**SPECIALS**

2000 KW Turbo-Generator, 60-3-480 V. Surface Condenser, Reconnect 600 V.—2300 or 4000 V. Rewind in 5 Weeks
1500 KW-Non Cond. Turbo Generator Unit 3600 RPM
5000 KW otherwise as above, except 2300/4000
3500 KW Turbo 60-3-2300 V. Jet Cond.
2500 " " " " Surface Cond.
1500 " " " " Jet Cond.
1250 " " " " Jet Cond.
1000 " " " " Surface Cond.
750 " " " " Surface Cond.
500 " " 60-3-480 V. Surface Cond.
Boilers 4—1000 HP., 4—750 HP., 2—500 HP., 4—560 HP.

*Also Smaller Water Tube & Fire Tube Boilers*

**CHARLES B. REARICK** **30 Church St., New York**

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**SQUIRREL CAGE**
**220/440 VOLTS**

| | |
|---|---|
| 1—200 HP GE IE 15K | 1200 |
| 1—200 HP WEM CS | 1200 |
| 1—100 HP GE KT | 900 |
| 1—100 HP Allis | 900 |
| 3—150 HP GE IK | 1200 |
| 1—150 HP WEM CS | 1200 |
| 1— 75 HP WEM CS | 580 |
| 1— 75 HP GE IK | 690 |
| 1— 75 HP GE IK | 600 |
| 1— 50/100 HP WEM CS | 345/700 |
| 1— 50 HP GE IK, 3 bearing | 490 |
| 3— 50 HP GE IK | 1200 |
| 2— 75 HP GE IK | 1200 |
| 1— 75 HP WEM CS | 1200 |
| 1— 40 HP GE KT | 1200 |
| 1— 40 HP GE KT | 690 |
| 1— 40 HP WEM CS | 1160 |

**SQUIRREL CAGE**
**2300 VOLTS**

| | |
|---|---|
| 1—200 HP GE I-K | 1800 |
| 1— 75 HP Allis | 1800 |
| 1—150 HP GE I-K | 720 |
| 2— 50 HP GE KT | 600 |
| 1— 40 HP GE KT | 1200 |
| 1— 40 HP Electro Dyn. | 1800 |
| 1— 30 HP F. B. Morse | 1200 |
| 1— 75 HP GE KT | 600 |
| 1— 60 HP GE IQ 2 ph. | 690 |
| 2—300 HP GE IE | 1800 |

**NEW 230 VOLTS SK**

| | |
|---|---|
| 1—30 HP SK 93 | 1750 CP |
| 1—20 HP SK 100-L | 900 CP |
| 2—25 HP SK 100-L | 1150 CP |
| 1—20 HP SK 93 | 1150 CP |
| 1—10 HP SK 60-L | 1150 CP |

MOTORS
TRANSFORMERS
GENERATOR SETS
ROTARY CONVERTERS
ALTERNATORS
PUMPS
HOISTS
COMPRESSORS

**Approximately 4000 other AC-DC Motors — Motor Generator Sets — Transformers—Pumps—Fans—Compressors—Hoists, etc.**

## PENN ELECTRICAL ENGINEERING COMPANY

**517 ASH STREET, SCRANTON, PA.**

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## *Motor Generator Sets—Synchronous Motors, etc.*

**MOTOR GENERATOR SETS & ROTARIES**
**3 phase, 60 cycle, A.C.**

2—West. 250 KW 250 Volt rotaries
1—West. 100 KW 250 Volt rotaries
1—West. 150 KW 275 Volt M. G.

**VERTICAL MOTORS**

1—G. E. 50 HP 1200 RPM 3 phase 60 cycle 220 Volt
1—Reliance Fan-cooled new 25 HP 1750 RPM 220/440 Volt

**SYNCHRONOUS MOTORS**
**3 phase, 60 cycle**

2—G. E. 700 HP 720 RPM 6600/4000/2300 Volt
1—Burke 300 HP 900 RPM 440/220 Volt
1—Ideal 50 HP 600 RPM 2300 Volt

**SLIP RING MOTORS 3 phase, 60 cycle**

Allis-Chalmers 250 HP 600 RPM 440 Volt
G. E. 60 HP 600 RPM 440 Volt
G. E. 62½ HP 1150 RPM 440/220 Volt
G. E. 25 HP 1150 RPM 220 Volt

**ADJUSTABLE SPEED D.C. 230 Volt**

1—West. Sk-180 100 HP 600/950 RPM
2—Electro Dynamic 60 HP 450/1200 RPM
1—Electro Dynamic 60 HP 525/1100 RPM
1—Reliance 1400-T 50 HP 175/700 RPM
1—G. E. 25 HP 400/1600 RPM
1—Reliance 25 HP 500/1500 RPM
3—G. E. 15 HP 450/1800 RPM
1—G. E. 15 HP 550/1100 RPM
1—G. E. 15 HP 500/1500 RPM
4—Electro Dynamic 15 HP 300/1200 RPM
1—G. E. 10 HP 250/1000 RPM
1—West. 10 HP 400/1600 RPM

**ALTERNATOR SPECIAL, Allis-Chalmers, 125 KVA, 277 RPM, 3 phase, 60 cycle**

## *The Electric Motor & Repair Co., Cuyahoga Falls, O.*

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## LOCOMOTIVE

1—American 40 ton, 4 wheel, standard gauge, saddle tank, cylinders 14 x 22, ASME boiler, 190# working pressure. Sale or rent. Immediate delivery.

## LOCOMOTIVE CRANE

1—American Hoist & Derrick Co. 18 ton, standard gauge, 45' boom, gasoline driven, thoroughly modern and in condition like new. Sale or rent.

## CRAWLER CRANES

1—Northwest ¾ yd. combination shovel and crane, 45' crane boom and fairleads; also, one Lorain Universal ½ yd. capacity with 24' boom, 15' jib; both with double drums for clam shell work.

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## DIESEL ENGINES AND GENERATOR SETS

***IN OUR STOCK***

1—25 HP Fairbanks Morse.
3—50 HP Int. Harvester UD-9.
1—68 HP Buda.
1—80 HP Atlas Imperial.
2—100 HP Fairbanks Morse.
1—112½ HP Buckeye.
2—180 HP Fairbanks Morse.
1—360 HP Fairbanks Morse.
1—440 HP Ingersoll-Rand.
2—120 HP Atlas-Imperial with clutch and power take-off.
2—150 HP Hercules with clutch and power take-off.

**A. G. SCHOONMAKER COMPANY**
50 Church Street — Phone—Worth 2-0455-6-7 — New York, N. Y.

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## 300 KW ROTARY CONVERTER

1—300 KW Westinghouse Rotary Converter, 600 volts D.C. 6 ph. 60 cy., pedestal bearings, 1200 RPM.

## TRANSFORMERS

1—750 KVA Uptegraff 3 ph., 6600-4000.
1—100 KVA Pittsburgh 2200-220/440
3—75 KVA Pittsburgh 4000-230/440.
3—37½ KVA Westghse 4000-230/460.
1—37½ KVA Westghse. 2200-440.
2—37½ KVA Westghse. 2300-110/220.
1—37½ KVA Pittsburgh 2300-230.
1—15 KVA Pittsburgh 550-110/220.
1—10 KVA Allis. Chal. 600-115/230.
1—5 KVA Westghse. 2300-110/220.
10—1½ KVA Gen'l. Elect. 2300-110/230.

## ELECTRIC EQUIPMENT
FOR
## INDUSTRY

**LET US KNOW YOUR REQUIREMENTS**

## 100 KW ROTARY CONVERTER

1—100 KW General Electric Type TCC Form A Synchronous Rotary Converter for 250 volts D.C., 3 phase, 60 cycles, 230 volts A.C. complete with Transformer and Switchboards.

## MILL AND CRANE MOTORS

CO-2011 MDS-109½, MC-90, CO-1812 MDS-108, CO-2007. CO-1810.

## 230 V.D.C. MOTORS

1—150 HP., W.E. Co., Type SK, 1750 RPM.
1—75 HP., W.E. Co., Type SK, 575/1150 RPM.
6—20 HP., G. E. Co., Type EC, 1150 RPM.
5—15 HP., G.E., Type LC, 300/600 RPM.
3—13½, W.E. Co., Type SK, 730/1460.
1—15 HP., G. E. Co., Type EC, 850 RPM.
5—15 HP., C. W. Co., Type CM, 1400/1700 RPM.
2—5 HP., G. E. Co., Type EC, 1150 RPM.
1—5 HP., W. E. Co., Type SK, 1100 RPM.
4—3 HP., W. E. Co., Type SK, 1150 RPM.

**FREQUENCY CHANGERS — TURBO GENERATORS — AC & DC MANUAL MAGNETIC CONTROL — CENTRIFUGAL PUMPS — AC & DC SWITCHBOARDS**

*FOR DETAILS, WRITE* **JOHN D. CRAWBUCK CO.** *714-15 EMPIRE BLDG. PITTSBURGH, PENNA.*

# SEARCHLIGHT SECTION

## POWER EQUIPMENT FOR PROMPT SHIPMENT

(3ph. 60 cy.)

| HP | Make | Volts | Speed | Type |
|---|---|---|---|---|
| 700 | G.E. | 6600 | 1800 | |
| 450 | West. | 2200/220/440 | 600 | CS |
| 400 (5) | West. | 2200/220/440 | 500 | CS |
| 250 | West. | 2200/220/440 | 500 | CS |
| 200 | Al.Ch. | 2200 | 600 | |
| 150 | West. | 220/440 | 580 | CCL |
| 125/40 | Cr.Wh. | 2200 | 700 | 125 AQ |
| 125 | Cr.Wh. | 2200 | 700 | 125 AQ |
| 100 | Burke | 220/440 | 900 | |
| 100 | F. M. | 220/440 | 600 | BB |

### DC SERIES WOUND MOTORS

| HP | Make | Type | Speed |
|---|---|---|---|
| 15 | West. | | 650 |
| 25 | Shaw | | 600 |
| 30 | G.E. | CO2002 | 610 |
| 35 | Cr.Wh. | SM | 565 |
| 50 | Shaw | | 600 |
| 75 | G.E. | 211 Int. | 550 |
| 100 | G.E. | MD108 | 480 |
| 130 | G.E. | CO1812 | 550 |
| 175 | G.E. | MDS 1904 | 475 |

SYN. MOTORS, 3 ph. 60 cy.

| HP | Make | Volts | Speed |
|---|---|---|---|
| 300 | Al.Ch. | 2200 | 600 |
| 75 (2) | G.E. | 2200 | 900 |

### SLIP RING MOTORS (3 ph. 60 cy.)

| HP | Make | Volts | Speed | Type |
|---|---|---|---|---|
| 1000 | Al.Ch. | 440 | 235 | |
| 700 | G.E. | 2200 | 393 | MT 432 |
| 300 | G.E. | 440 | 600 | I-M |
| 200 | G.E. | 2200 | 240 | MT 412 |
| 150 | G.E. | 220/440 | 720 | I-M |
| 150 | G.E. | 220 | 575 | I-M |
| 125 | Al.Ch. | 2200 | 435 | |
| 100 | Al.Ch. | 220/440 | 575 | |
| 100 | G.E.-25 cy. | 220/440 | 500 | MI-108 |

### "Wound Rotor Motors" (3 ph. 60 cy.)

| HP | Make | Volts | Speed | Type |
|---|---|---|---|---|
| 200 | G.E. | 2200 | 600 | I-L |
| 150 | G.E. | 2200 | 600 | I-L |
| 125 | G.E. | 2200 | 600 | I-L |

**OIL ENGINE DRIVE AIR COMPRESSOR**

Chicago Pneumatic simplate valve type NSO3 straight line 16½ & 11 x 18" capacity 492 cu. ft. displacement, 100# pressure, with air receiver and starting air compressor.

### M-G SETS 3 ph. 60 cy. (Syn.)

150 KW G.E. Type HCC 6 Rotary Con. 250 v. DC 2200 or 4000 v. AC
150 KW West. 550 v. DC—2200 AC 1200 RPM
125 KW Cr. Wh. 250 v. DC—440 v. AC 1200 RPM
100 KW G.E. 550 v. DC—2200 v. 900 RPM
90 KW Al. Chal. 230 v. DC 2200 v. AC 900 RPM

### SHOP HOISTS

1—1 Ton Euclid AC Hook type, floor control
1—3 Ton Euclid AC Monorail with push trolley
1—1 Ton Sprague 230 v. DC
2—2 Ton Sprague 230/500 v. DC Monorail
2—5 Ton Northern AC Monorail Hoists on 35' Cranes

*In addition to the above, we have hundreds of other items in stock—kindly send us your inquiries.*

**MOORHEAD-REITMEYER CO., INC.**
**Pittsburgh, Pennsylvania**

*IF YOU DON'T KNOW MACHINERY—KNOW YOUR MACHINERY DEALER*

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***NEW and USED!***

*All makes & sizes for prompt shipments*

1—1000 H.P. B&W. Stirling 175#.
2—500 H.P. Stirling 160#.
6—500 H.P. Edge Moor 200#.

**J. F. DAVIS CO.**
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ALL SIZES AND ALL TYPES

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INDUSTRIAL POWER HEATING

INQUIRIES WELCOMED ALL STATES

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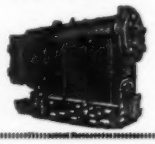

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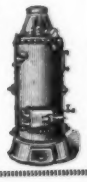

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## STEEL TANKS—PUMPS

22,000 gal. Tank on 44 ft. Tower.
35,000 gal. Tank on 90 ft. Tower.
40,000 gal. Tank on 100 ft. Tower.
50,000 gal. Tank on 100 ft. Tower.
80,000 gal. Tank on 68 ft. Tower.
100,000 gal. Tank on 40 ft. Tower.
1,000, 5,000 & 10,000 BBl. Oil Tanks.
3—20,000 gal. Horizontal Oil Tanks.
6—11,000 gal., 12—5,000 gal. Horizontal Tanks.
3—500-750 & 1,000 GPM. Steam Underwriters Fire Pumps.

*Tanks and Pumps bought and sold.*

**TIDEWATER**
**EQUIPMENT & MACHINERY CORP.**
60 E. 42nd St. New York, N. Y.

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## FOR SALE—USED DIESEL

1—60 K.W. BURKE 3/60/220 Generator directly connected to "Standard" 6 cylinder heavy duty Diesel Engine, 600 R.P.M.
Complete with excitor, main panel board, and automatic voltage control.

**MOREY MACHINERY CO., INC.**
410 Broome Street New York, N.Y.

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## FOR SALE
## FROM SALT LAKE CITY, UTAH:

1—520 HP HAMILTON CORLISS ENGINE GENERATOR SET, DIRECT CONNECTED TO G. E. 360 KW GENERATOR, 3/60/480 VOLT, 150 RPM, WITH G. E. EXCITER AND WESTINGHOUSE 3 PANEL SWITCHBOARD.

*"Your inquiries solicited"*

**BRILL Equipment Co.**
183 VARICK STREET NEW YORK

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## FOR SALE
## PUMPS

1—No. 5 Class F.V. Cameron Centrifugal pump, 600 GPM—30' head.
1—Class 5 HD Penn. Centrifugal pump, 1200 GPM, 100' head.
1—Type SN—size 4 Economy Pump, centrifugal, 400 GPM—90' head.
1—No. 4 Class LV Cameron centrifugal pump, 600 GPM, 140' head.

Each of the above pumps is mounted on a base but less driver.

**A. J. BLECKI**
408 Donovan Bldg. Detroit, Mich.

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## PIPE

CUT TO SKETCH ⅛ to 24"

**METROPOLITAN**
**PLUMBING SUPPLY CO., INC.**
INDUSTRIAL AND MARINE SUPPLIES
Large SURPLUS STOCKS
STEEL--WROUGHT IRON--CAST IRON
BRASS-COPPER-CEMENT LINED PIPE
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HOURLY NATION-WIDE SHIPMENTS
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FLANGED VALVES & FITTINGS

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## DIESEL GENERATOR

General Electric Generator 37.5 KVA, 3 phase, 60 cycle, 240 volts, driven by direct connected 50 H.P. Buda Diesel 6 cylinder Engine. In service.

**RICHARD P. WALSH CO.**
Cortlandt 7-0723 30 Church St., N. Y.

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2—600 Cu. ft. Diesel Compressors
2—500 HP. AC Engine Diesel sets
Other smaller Diesel sets
1—15 ton Locom. CRANE, 50' boom

**Stephen A. Douglass Co.**
630 Fort Wahington Ave., New York, N. Y.

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## FOR SALE

1—75 Ton O.E.T. Crane, 65' Span
1—50 Ton Whiting Electric Hoist
1—150, 120, 65 & 25 HP Diesels
1—400 ft. Span Bridge Type Crane
1—60 Ton Whiting Hook with 4 Sheaves
2—357 HP. 175# Heine Type W.T. Boilers
1—100 KW 440-3-60-900 RPM Belted Gen.
1—50,000 Gallon Water Tank on Tower

**H. & P. MACHINERY COMPANY**
5819 Enright Ave. St. Louis, Mo.

# NEED POWER EQUIPMENT?

## (Try Us!!!)

### BOILERS

3—300 H.P. B. & W., 160#
4—450 H.P. B. & W., 180# senous
1—504 H.P. Sterling, 165# Class 2-30
6—600 H.P. B. & W., 183# with stokers

### COMPRESSORS

1—300 C.F.M. Chi. Pneu. steam-driven
1—400 C.F.M. Ingersoll-Rand with 75 H.P. A.C. Motor
1—1000 C.F.M. Laidlaw Dunn, steam-dr.
1—4000 C.F.M. Nordberg with 750 H.P. Diesel engine

### USED D. C. MOTORS

3 H.P. G.E., 230 V. shunt wound, 1150 RPM
3 H.P. Reliance, 220 V., 600/1200 RPM
3½ H.P. West. Elec., 220 V., 850 RPM
5 H.P. C-W, 220 V., 950 RPM
5 H.P. Watson, Vert., 1300 RPM
5 H.P. G.E., 330 V. comp. wound, 850 RPM
5 H.P. C.W., 230 V., 950 RPM
5 H.P. G.E., 230 V., shunt wound, 1100 RPM
7½ H.P. G.E. Shunt wound, 825 RPM, 230 V. D.C.
7½ H.P. West. #6 Type "S" shunt wound, var. sp.
8 H.P. G.E., 230 V. D.C. 810 RPM
8 H.P. C-W, 220 V., 535/1070 RPM
10 H.P. G.E. shunt wound, 230 V. D.C., 650 RPM
10 H.P. A.C. inter. duty, 220 V. D.C., 500/1200
10 H.P. Triumph shunt wound, 230 V. D.C., 760 RPM
13 H.P. Westg. #8 Type S, 220 V. D.C., var. speed, 375/750 RPM
15 H.P. Westg., 220 V. 500/100 RPM
42/50 H.P. West. 220 V. D.C., variable speed 500/1000 RPM, chunt wound

### HOIST MOTORS

2—50 H.P. Ft. Wayne Elec. Co. Type "K", 600 RPM, 220 V. D.C.

### GENERATORS

40 KW G. E. Type MP 110 V. D.C., belt drive, 860 RPM, 360 amps.
200 KW West. #201 SK, comp. wound, 600 V. D.C. with 290 H.P. syn. motor, 3/60/2200, 900 RPM
300 H.P. Buckeye Diesel Engine & Gen. 3/60/240.
500 KW G.E. Skinner Uniflow Steam Eng. Gen., 250 V. D.C.
100 KW G.E. Type ATB-2-1250-3600 Form T, 814 amps. 3/60/2200-900 RPM
5000 KW Turbo Generator, 3/60/2300 3600 RPM, 185# W.P.
POWER PLANT—Complete with two 625 KW Turbo Generators 3/60/2300, complete with 309 H.P. each Heine Water Tube Boilers, 225# steam pressure

### USED A. C. MOTORS

(Squirrel Cage)

15 H.P. Howell, 3/60/440, 600 RPM
15 H.P. Gen. Elec., 3/60/220, 1200 RPM
15 H.P. West., 3/60/440, 850 RPM
15 H.P. Wagner, 3/60/440, 850 RPM
20 H.P. Howell, 3/25/440, 750 RPM
20 H.P. Westg. Type CCL, 3/60/220, 850 RPM
20 H.P. Gen. Elec., 3/60/400, 900 RPM
25 H.P. A.C., 3/60/220, 1200 RPM
25 H.P. West. Elec., 3/60/440, 865 RPM
25 H.P. Gen. Elec., 3/60/440, 1200 RPM
30 H.P. Westg., 3/60/220, 1800 RPM
30 H.P. Westg., 3/60/440, 840 RPM
30 H.P. Gen. Elec., 3/60/440, 900 RPM
30 H.P. Gen. Elec., 3/60/440, 870 RPM
35 H.P. West., 3/60/440, 800 RPM
37½ H.P. Lincoln Vert., 3/60/220, 1200 RPM
40 H.P. Gen. Elec., 3/60/440, 1200 RPM
40 H.P. Gen. Elec., 3/60/440, 900 RPM
40 H.P. West. Elec., 3/60/200, 1140 RPM
40 H.P. Gen. Elec., 3/60/440, 870 RPM
40 H.P. Westg., 3/60/440, 870 RPM
50 H.P. Howell, 3/60/440, 900 RPM
50 H.P. Watson, 3/60/440, 1720 RPM
75 H.P. Gen. Elec., 3/60/440, 900 RPM
75 H.P. Westg., 3/25/400, 450 RPM

We also have on hand miscellaneous electrical items, such as:

OIL SWITCHES
OIL CIRCUIT BREAKERS
LIGHTING GENERATORS
COMPENSATORS
100 H.P. SOLENOID ELEC. BRAKE

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2—DC. Generators; G.E.; 68 Amps; 125 V; 8.5 KW; 257 RPM
1—Standard Diesel; 3 cyl; 10¾x15 with
1—A.C. Generator; G.E.; 3/60/2300; 35.7 Amps; 120 KW; 257 RPM
2—Standard Fuel Oil Engines; single cyl; 14x20 with
2—A.C. Generators; G.E.; 3/60/2300; 25 Amps; 75 KW; 225 RPM
1—Standard Fuel Oil Engine; single cyl; with
1—A.C. Generator; G.E.; 240 V; 120 Amps; 50 KW; 225 RPM

*All engines built by Hadfield-Penfield Steel Co., Bucyrus, Ohio*

2—Water Tube Boilers, Franklin, 200 BPH each
3—Feed Water Heaters, coil type
1—Air Compressor, Ingersoll Rand, twin cyl.; steam cyl. 20 x 16 and 12 x 16; air cyl. both 14 x 16
1—Air Compressor, Sullivan, twin cyl. 14 x 14 x 12 each
1—Duplex Steam Pump, Worthington, double Lead, 10 x 17 x 22 x 15
1—Surface Condenser, Alberger, 700 sq.ft. ½" brass tubes direct connected to
1—Steam Pump, Alberger, double end, 8 x 12 x 12

Above equipment located near Galveston, Texas

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1—C.H. & E. Model #11, C.A., capacity 125 GPM at 320# pressure—4½ x 5½ single acting Triplex Road Pump with Waukesha 6 cylinder 45 H.P. gasoline engine.
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1—Gorman Rupp R 125, Triplex Pump on trucks, 125 GPM at 320# pressure with Hercules 40/50 H.P. gasoline engine.

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Bids will be accepted for all or any part of units offered for sale. Sale authorized by Bureau of Docks, U. S. Navy. Any or all equipment can be withdrawn at the discretion of the advertiser. Other miscellaneous equipment available. Send us your inquiries.

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U. S. Naval Supply Depot

Bayonne 3-5800 Bayonne, N. J.

## January Specials

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1—25 HP GE-MTC 3/60/550/720 New
1—60 HP GE-MTC 3/60/550/900 New
1—6.6 KW 115 DC to 3/60/229 MG Set, GE Factory built.
2—50 HP A.C. Slipring 3/60/220/900

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Worth Dup. Pump size 16x12x12, cap. 1100 gpm. heavy water wks. type.
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1—24" Crane 125# Flanged Hand Wheel operating Gate Valve.

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20" dredge pump 1200 H.P. Motor
20" dredge pump 1000 H.P. Motor
15" dredge pump 500 H.P. Motor
12" dredge pump 400 H.P. Motor
24" dredge pump new
15" portable steel hull dredge Elect.
6" portable steel hull dredge gas.
2—Steel spuds 36"x36"x70"
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800 H.P. tug steam oil burning wood
Dredges and dredge equipment.

## H. P. GUION

303 West 42nd St. New York City

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3—520 HP. B & W Superheaters and Stokers.
5—604 HP. Babcock & Wilcox 200 lb.

We specialize in high pressure boiler fittings, Boiler-Supports Superheaters pop safety valves, blow-off valves, steel headers, steam valves up to 600 lbs. up to 24" in diameter, turbine and motor driven boiler feed boilers—high and low pressure pumps.

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**Heat Exchanger 606 tubes 1¼ x 9' 6" long.**
**1500 CFM 2 STAGE AIR COMP. 275 HP. SYN. MOTOR DRIVE.**
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**Traveling Crane 75 ton Case, 64' span, 3 Motors.**
**750 KW. and 110 KW. AC Hydro Elec. Plants (also others).**
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G.E., type H, 60 cy., single phase
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*Departmental Staff*
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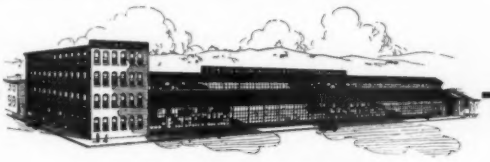

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Oil Burners Installed by Petroleum Heat & Power Co.

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Complete Switchboard with all necessary Instruments.

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Vacuum Pump, Motor Driven

Sump pump, motor driven

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All Pipings, fittings, valves, & header

All Non Return Valves, Bends to Header, and everything pertaining to make up a complete power plant.

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125 ton, 400 foot span, Bridge Crane.

*Overhead Traveling Crane Rebuilders.*

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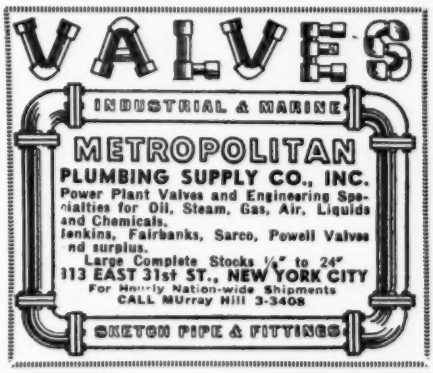
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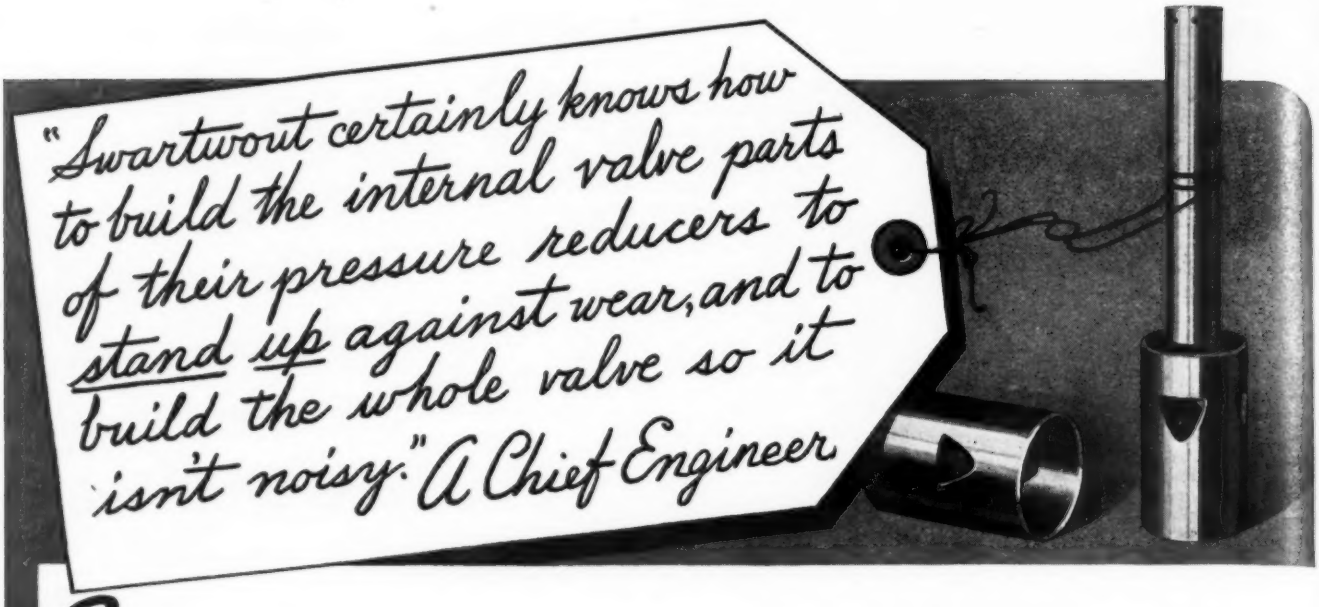
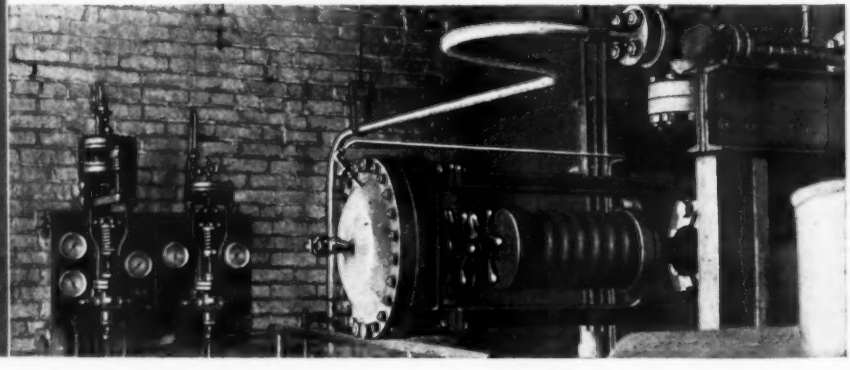

"Swartwout certainly knows how to build the internal valve parts of their pressure reducers to stand up against wear, and to build the whole valve so it isn't noisy." A Chief Engineer

# Seven years without a penny of maintenance expense—a record you too can enjoy with Swartwout Equipment

DEPENDABILITY you can bank on is built into every piece of Swartwout Equipment. You save on maintenance, and enjoy continuous trouble-free operation • The chief engineer of a large industrial plant using Swartwout 1500 lb. standard Reducing and Desuperheating Equipment tells visiting engineers there has been no expense on the seat and disc in seven years. The valve operates every week-end and whenever the high pressure turbine is off the line—reduces initial 1250 lb. steam to 236 lbs. Opened for inspection after the first three years, the Stellite coated contact surfaces showed no wear—only a high polish • Swartwout engineers gladly discuss your needs with you or your consultants, assume unit responsibility for your reducing and desuperheating installation.

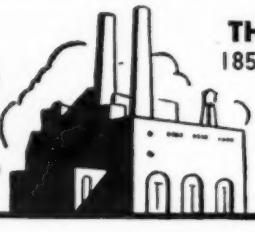
**LEFT:** Swartwout Reducing Valve. **BELOW:** Swartwout Master for Reducing Valve and Differential Control for water supply. Swartwout F. W. Regulators serve the boilers.



Feed Water Regulators • Pump Governors • Feed Water Heaters
Master Controls • Reducing Valves • Separators • Exhaust Heads

**Swartwout**

•Power Plant Equipment•



**THE SWARTWOUT COMPANY**
18543 Euclid Avenue • Cleveland, Ohio

* * *

*Controlled* **AIR CIRCULATION**
**for Power Plants and Industrial Buildings**

# ENGINEERED

## for Better Hanging of Power Piping

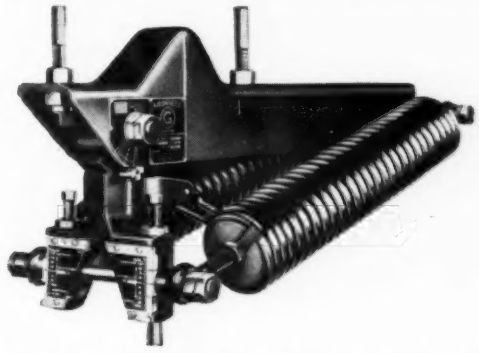
***GENSPRING** Constant-Support Hangers are custom-made from standard parts . . . pre-fitted to each installation!*

• • •

Write for Data Book containing complete details of GENSPRING Constant-Support Hangers for loads from 250 to 8,500 lbs. Grinnell Co., Inc., Executive Offices, Providence, R. I. Branch offices in principal cities.

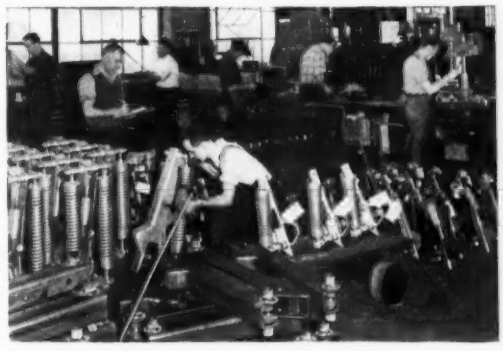
## FOR CONSTANT SUPPORT...

Through exclusive patented design, GENSPRING Hangers provide *constant support* for power piping in all "hot" and "cold" positions. The full safety factor of the supported system is always maintained.



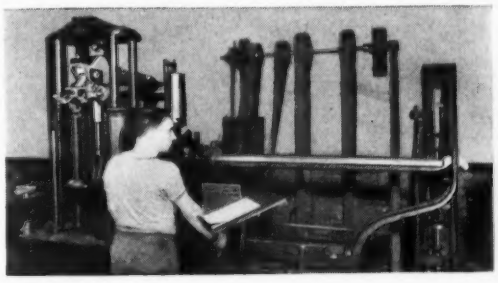
## FOR FAST PRODUCTION...

GENSPRING Constant-Support Hangers are manufactured by efficient mass-production methods. Every unit is engineered to the user's specifications, then assembled from standard precision parts.



## FOR PERFORMANCE...

Each GENSPRING Constant-Support Hanger is *pre-tested and calibrated* under conditions that duplicate its actual-service requirement. There's no need for load adjustment on the job . . . no chance of misfit hanger installations.



***GENSPRING*** **CONSTANT-SUPPORT HANGERS BY** **GRINNELL**

**WHENEVER PIPING IS INVOLVED**

HOW TO SOLVE
Operating Problems with Correct Lubrication
BETWEEN OILINGS, THIS OIL FILM MUST PROVIDE "BOUNDARY LUBRICATION"

ONE OF A SERIES OF SUGGESTIONS TO AID PRODUCTION

# Save Production Time Here!

**PROBLEM:** That red film of oil you see on the journal above is ample—at the time the bearing is oiled. But before the next application, the oil will drain off. Just a tissue-thin film — boundary lubrication — will remain. If you use ordinary mineral oil the film may not stand up. Metal-to-metal contacts between journal and bearing may result. Bearings fail. Important machines stop producing.

**ANSWER:** There is an oil specially made to meet this problem. It is called Gargoyle Vactra Oil. It has an extremely tenacious, persistent film that resists wiping action and rupture even when a film of microscopic thickness remains. Wear, temperature rise and power consumption are minimized with an extremely small supply of this oil. You are assured dependable operation and economy, too.

GARGOYLE Lubricants

SOCONY-VACUUM OIL COMPANY, INC.—Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. White Eagle Div. • Wadhams Div. • Southeastern Div. (Baltimore) • Magnolia Petroleum Co. • General Petroleum Corp.

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